amateur radio

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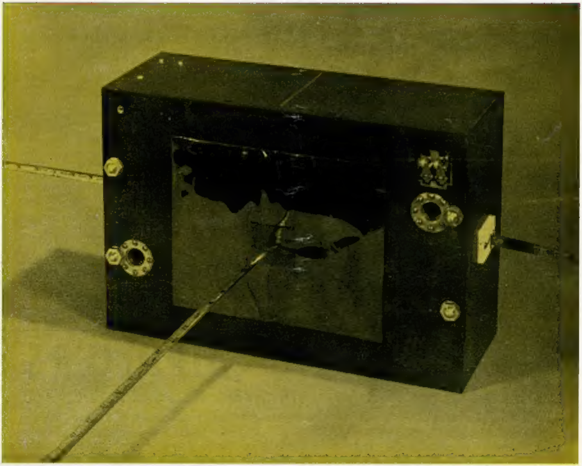

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amateur radio

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Members of the W.I.A. should refer all enquiries regarding delivery of "A.R." direct to their Divisional Secretary and not to "A.R." direct. Two months' notice is required before a change of mailing address can be effected. Readers should note that any change in the address of their transmitting station must, by P.M.G. regulation, be notified to the P.M.G. in the State of residence; in addition, "A.R." should also be notified. A convenient form is provided in the "Call Book".

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COVER STORY

The Australis Oscar 5 Satellite. The yellow section in centre is a thermal blanket designed to maintain internal temperature at 70°F. Black paint protects the chromium plating which covers remainder of the satellite and will be removed shortly before launching.

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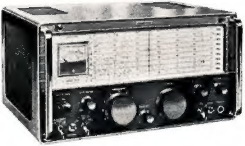

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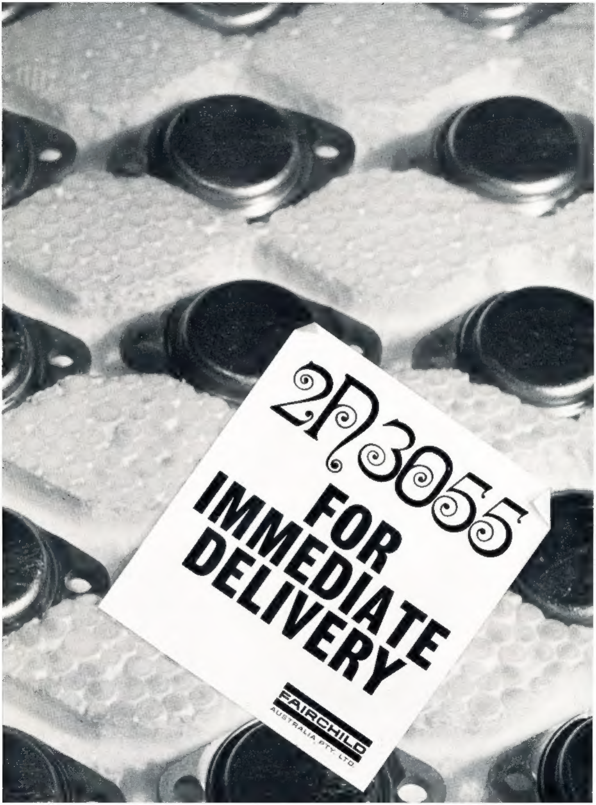
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—Arie Bles

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4CX250B[1]	AB1/SSB	2000	.1/.25[3]	350	—55[5]	0	0/.005[3]	0	300	6.0 / 2.6
	C/CW	2000	.25	250	—90	2.9	.019	.026	390	
	C/AM	1500	.20	250	—100	1.7	.02	.014	235	
4CX300A	AB1/SSB	2500[6]	.1/.25[3]	350	—55[5]	0	0/.004	0	400	6.0 / 2.6
	C/CW	2500[6]	.25	250	—90	2.8	.016	.025	500	
	C/AM	1500	.20	250	—100	1.7	.02	.014	235	
4CX1000A	AB1/SSB	3000	.25/.90[3]	325	—60[5]	0	—.002/.036	0	1660	6.0 / 10.5
4-65A	AB1/SSB	3000	.015/.065[3]	360	—85[5]	0	0/.006	0	130	6.0 / 3.5
	C/CW	3000	.112	250	—105	1.6	.022	.009	270	
	C/AM	2500	.102	250	—150	3.1	.026	.013	210	
4-125A	AB1/SSB	3000	.03/.105[3]	510	—95[5]	0	0/.006	0	200	5.0 / 6.5
	B/SSB[4]	3000	.02/.115[3]	0	0	16	0/.03	0/.055	240	
	C/CW	3000	.167	350	—150	2.5	.03	.009	375	
	C/AM	2500	.152	350	—210	3.3	.03	.009	300	
4-250A	AB1/SSB	3000	.055/.21	600	—110[5]	0	0/.012	0	400	5.0 / 14.5
	C/CW	3000	.345	500	—180	2.6	.06	.01	800	
	C/AM	3000	.225	400	—310	3.2	.03	.009	510	
4-400A	AB1/SSB	3000	.09/.30[3]	610	—140[5]	0	0/.018	0	500	5.0 / 14.5
	B/SSB[2][4]	3000	.07/.30[3]	0	0	40	0/.055	0/.10	520	
	C/CW	3000	.35	500	—220	6.1	.046	.019	800	
	C/AM	3000	.275	500	—220	3.5	.026	.012	630	
4-1000A	AB1/SSB	4000	.17/.48[3]	1000	—130[5]	0	0/.04	0	1130	7.5 / 21.0
	B/SSB[4]	4000	.12/.67[3]	0	0	106	0/.08	0/.15	1870	
	C/CW	4000	.70	500	—150	12	.137	.039	2100	
	C/AM	4000	.60	500	—200	11	.132	.033	1910	
3CX100A5	C/CW[7]	800	.08	—	—20	6	—	.03	27	6.3 / 1.0
2C39A	C/AM[7]	600	.065	—	—16	5	—	.035	16	

[1] Ratings also apply to 4X250B.
[2] Ratings apply to 4-250A within plate dissipation limitation.
[3] Zero signal and maximum signal dc current.
[4] Grid and screen grounded, cathode driven.
[5] Adjust to give stated zero-signal plate current.
[6] For operation below 250 Mc only.
[7] At 500 Mc.

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ETG 1169

COMMENT:

A VK HI IN THE SKY

Don't brag; don't appear patronising; and let me check your spelling. That was the Editor's advice to me before I wrote my first Federal Comment.

But this time we are going to brag—we've certainly got something to brag about! With any luck, shortly after this issue is published, Australis Oscar 5 will be launched! (That's why we have the special cover for this issue.)

The four Amateur Satellites launched to date have all been built in the United States. The fifth to be launched was designed and built in Australia. That is something to brag about! It represents a tremendous achievement for the many people involved; in particular the W.I.A. Project Australis Group.

The package has passed its sophisticated and lengthy pre-launch tests. It has "qualified" to be launched! Now, all we have to hope is that the launch is successful.

Whatever happens now cannot take away any of the credit that belongs to the group that have built Australis Oscar 5.

We can all be proud of this group of Australian Amateurs. Their achievement is something that we can all share by observing the satellite. But to them must be given the credit; to the W.I.A. Project Australis Group we say "Good luck and congratulations!"

NOVICE LICENSING

Between 1959 and 1968 it was the policy of the Wireless Institute of Australia to advocate a form a Novice licence system in this country. In detail, the following was the specific proposal advanced by the Institute:

(a) Morse code test of 5 words per minute.

(b) Elementary examination in radio theory and P.M.G. Regulations at a lower standard than that required for A.O.C.P.

(c) Operation to be allowed on the 3.5, 27 and 28 Mc. bands using c.w. only and crystal control.

(d) Power input maximum of ten watts.

(e) The A.O.C.P. exam. must be taken by the end of 12 months. The licence is not to be renewable except at the discretion of the Postmaster General's Department.

Attempts to persuade the Australian Administration to introduce such a system had always met with failure—which, in itself, is of course no reason for abandoning a policy. However, at the 1968 Federal Convention, the Divisions decided, through the Federal Council, that we, as an organisation, should no longer advocate the issue of a Novice licence by our Administration.

It was obvious that, despite the result, the issue was still an open one. In fact, three Divisions voted in favour of the change, two against and one abstained. Two factors that may have played some part in the change of policy were the reduction by the Australian Administration of the code standard for Amateur licensees from 14 words per minute to 10 words per minute and the lowering of the age limit at which an Amateur licence could be held.

The last nine months has seen a much revived interest in Novice licensing. Many people, some deeply involved in the Youth Radio Club Scheme, have drawn attention to the Institute's present policy, both in our own journal and in other journals. "Amateur Radio" has received a number of letters to the Editor on this topic and perhaps significantly, not one has opposed the concept of Novice licensing. This interest has led the Federal Executive to the view that the Federal Council should again review the Institute's policy towards Novice licensing. Accordingly, it will propose the appropriate motion at the next Federal Convention. This is not to say that the Executive is advocating a change; on this matter the Executive simply raises the issue, but at least at this time, makes no recommendation to the Federal Council. I have referred to this matter at this early stage in a Federal Comment because a Novice licensing system will affect all Amateurs. By raising the issue at an early stage, I hope that all Divisions will be able to obtain the views of their members well before the Federal Convention. I hope that all Amateurs give some thought to this undoubtedly difficult question.

The arguments advanced by those for and against a Novice licensing system are fairly well known. Those in favour say that through this means we will attract new Amateurs to our ranks that we would not have otherwise attracted; that the Novice licence is particularly suitable for young people where some practical experience, particularly within the framework of the Youth Radio Club scheme is the best training. Those in favour also rely on the fact that other countries (apart from the U.S.A.) issue such a licence, apparently quite successfully.

Those opposed to a Novice licence system argue that the evidence does not support the contention that people who become Amateurs would not have become Amateurs in any event; that limited frequency band allocations to licensees with severely limited privileges create "ghettos of the underprivileged" where novices lead each other into bad operating habits; that the standard in Australia for the Full licence is such that with application, anybody can attain it; that the Novice licence creates an underprivileged minority which is not in the best interests of Amateur Radio.

I do not pretend that the points I have mentioned are the only points for and against a Novice licence—they are not. Nor do I pretend that the points I have mentioned are necessarily the best points that either side would raise. I have quoted them as an example of the sort of issues that are raised by this question. One does not have to look far before one finds the arguments, particularly those in favour of a Novice licence, presented very ably indeed. I urge all Divisional Councils and all members to give this matter serious consideration before the 1970 Federal Convention. I hope that this matter will be a topic at least at one general meeting in each Division before Easter 1970.

But please do not only ask the question, "Should we have a Novice licence" —do not assume that if the Institute answers that question, "Yes," that the Institute must necessarily have to advocate the form of licence it previously advocated, which is quoted above. If one concludes that we should have a Novice licence, then I think one should ask the question, "In what form do we want a Novice licence?" Indeed, it may well be easier to decide the first question after one has given some consideration at least to the second question. Open discussion on this sort of topic is, I believe, essential and one of the things that the Institute is all about. Don't be a fence sitter. Let your Council know what you think. Give your Federal Councillor any material that you think may be of assistance to him.

Whatever the result of a review of this question at the Federal Convention, I think that the criteria to be applied in judging the issue is clear. What is in the best interests of Amateur Radio? What do you think?

—Michael J. Owen, VK3KI,
Federal President, W.I.A.

SINCE the introduction of the 146 Mc f.m. net frequencies to this country, many Amateurs have come to realise the advantages that frequency modulation provides. However, many Amateurs have only a rather sketchy knowledge of the processes involved in the frequency modulation system. It is the purpose of this article to discuss some fundamental aspects of the f.m. system.

THE F.M. SYSTEM

R. F. DANNECKER, VK4ZFD*

DEVIATION

Everyone is aware of the process involved when an a.m. signal is produced. If the modulating signal is, say, 1 Kc., two sidebands, one at carrier frequency minus 1 Kc. (lower sideband, l.s.b.) and the other at carrier frequency plus 1 Kc. (upper sideband, u.s.b.) are produced. The total power in the sidebands is half the carrier power for 100% modulation (see Fig. 1a).

When a frequency modulated signal is produced with 1 Kc. modulating frequency, sidebands are produced at 1 Kc. intervals **to infinity** (see Fig. 1b).

However, beyond a certain point the amount of power contained in higher order sidebands is insignificant. The number of significant sidebands and the amount of power transmitted in them can be determined using Bessel functions. Two Bessel function charts are shown in Figs. 2a and 2b.

There are several points to note with reference to Fig. 1b:—

(a) The carrier power diminishes during modulation.
(b) The energy taken from the carrier goes into the sidebands—greater amplitude of modulating signal produces more energy in the sidebands.
(c) One or more sidebands can contain **more** power than the carrier.

A small amplitude audio modulating signal of frequency 1 Kc. may produce sidebands as shown in Fig. 3a. If the amplitude is increased, the frequency spectrum of the signal may change to that shown in Fig. 3b. The signal in Fig. 3b has greater deviation than that in Fig. 3a.

A signal modulated with a 1 Kc. tone with 10 significant sidebands requires a total bandwidth of 20 Kc., while a 100 cycle tone giving rise to 10 significant sidebands requires a total bandwidth of 2 Kc.

The bandwidth required for a signal therefore depends on:

(i) The intensity of the modulating signal.
(ii) The frequency of this signal.

The modulation index of a frequency modulated signal is defined as:

$$\text{modulation index} = \frac{\text{Deviation of F.M. Carrier}}{\text{Audio Freq. producing this Deviation.}}$$

For a maximum carrier shift of (±) 15 Kc. and a highest modulating frequency of 3 Kc., the modulation index = 15 ÷ 3 = 5.

From Fig. 2a we see that there are eight significant sidebands in this signal, i.e. although the carrier has shifted only (±) 15 Kc., significant sidebands have been produced to 8 × 3 = (±) 24 Kc.

The relative **amplitudes** of the sideband sets are obtained from Fig. 2b and are shown in Fig. 4 applied to a carrier aerial current of 9.0 amps.

Note that although the carrier is never shifted beyond (±) 15 Kc., significant sidebands are produced beyond this limit. Hence the seemingly wide spacing between f.m. channels.

Note also that for a modulation index less than 0.4, only two significant sidebands are produced. A modulation index of 0.4 with an upper audio limit of 3 Kc. corresponds to a carrier deviation of (±) 1.2 Kc. (see Fig. 5).

PHASE MODULATION

Consider an audio signal modulating a carrier such that the phase of the carrier is changed corresponding to change in the amplitude of the modulating signal. This is shown in Fig. 6a relative to a reference carrier whose phase is constant. An alternative representation in terms of rotating phasors is shown in Fig. 6b where OB is the reference carrier and OA is the phase modulated signal.

Actually, in Fig. 6b, OA is rotating at angular frequency ω, while the phase varies, relatively, very slowly. Consider now the change in vector OA in going from (i) to (ii) and (iv) to (v) in Fig. 6b. In the first case OA must speed up to go from position (i) to

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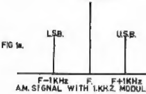
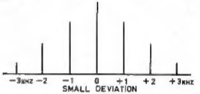
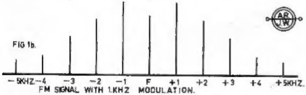


A.M. SIGNAL WITH 1.KHZ. MODULATION.

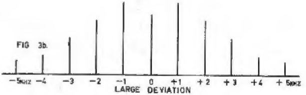


SMALL DEVIATION

Fig. 3a.



FM SIGNAL WITH 1KHZ MODULATION.



LARGE DEVIATION

Modulation Index	Number of Significant Sidebands Above Carrier	Below Carrier	Bandwidth Required
0.01	1	1	2f
0.05	1	1	2f
0.20	1	1	2f
0.40	1	1	2f
0.50	2	2	4f
1.00	3	3	6f
4.00	7	7	14f
5.00	8	8	16f
7.00	10	10	20f
10.00	14	14	28f

Note: f equals frequency of audio signal.

Fig. 2a.—Bessel Function Chart (1)

Modulation Index	Carrier Value	1st Set of Sidebands	2nd Set	3rd Set	4th Set	5th Set	6th Set	7th Set	8th Set	9th Set	10th Set	11th Set	12th Set	13th Set	14th Set
0.00	1.000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.01	1.000	0.005	—	—	—	—	—	—	—	—	—	—	—	—	—
0.05	.9994	.025	—	—	—	—	—	—	—	—	—	—	—	—	—
0.20	.9900	.0995	—	—	—	—	—	—	—	—	—	—	—	—	—
1.00	.7652	.4401	.1149	.0020	—	—	—	—	—	—	—	—	—	—	—
2.00	.2239	.5767	.3528	.1289	.0341	—	—	—	—	—	—	—	—	—	—
4.00	−.3971	−.0661	.3641	.4302	.2811	.1321	.0491	.0152	—	—	—	—	—	—	—
5.00	−.1776	−.3276	.0466	.3648	.3912	.2611	.1310	.0534	.0184	—	—	—	—	—	—
7.00	.3001	−.0047	−.3014	−.1676	.1578	.3479	.3392	.2336	.1280	.0589	.0235	—	—	—	—
10.00	−.2459	.0435	.2546	.0584	−.2196	−.2341	−.0145	.2167	.3179	.2919	.2075	.1231	.0634	.0290	.0120

Note: Where blank spaces are indicated the values of the sidebands are insignificant.

Fig. 2b.—Bessel Function Chart (2).

position (2), in the second case OA must slow down to go from position (1) to position (3). This speeding up corresponds to an increase in frequency of the carrier represented by OA and the slowing down corresponds to a decrease in carrier frequency.

Each time the carrier phasor wobbles back and forth to reach the new phase positions dictated by the audio modulation, we find the frequency also changes in order to have the phasors reach the new positions. Note, however, that over the whole audio cycle, the average frequency of the carrier represented by OA is constant.

In producing phase moduation of the carrier we have in fact produced indirect f.m. What we are doing is adding sufficient change either positive or negative to a fixed frequency to permit the carrier to reach the desired phase position. In "pure" f.m. the carrier frequency itself is **directly** affected and shifted in response to the modulating voltage.

FACTORS AFFECTING INDIRECT F.M.

The amount of indirect f.m. produced depends on the extent of phase shift and the frequency of the modulating audio signal. The extent of indirect f.m. produced varies directly with both the frequency and maximum phase shift of the carrier.

In direct f.m. the value of the carrier itself swings between its maximum limits. The carrier is shifted directly by the modulation. In indirect f.m. (from p.m.) the carrier is not actually shifted by the modulation. Rather, the effect of the phase shifts is to either add to or subtract frequency variations from a fixed carrier.

Sideband Set	Amplitude (Amps.)	Power (Arbitrary)
Carrier	1.598	2.50
1st Set	2.948	8.70
2nd	0.419	0.175
3rd	3.283	10.80
4th	3.521	12.40
5th	2.350	5.52
6th	1.179	1.39
7th	0.481	0.231
8th	0.166	0.0276

Fig. 4.—Power in Sidebands

INTERFERENCE

Consider two carrier waves slightly different in amplitude and frequency. The resultant of these two waves is shown in Fig. 7. There are two types of variation in this signal as compared to carrier 1. They are: (1) amplitude, (2) phase.

In a.m. systems type (1) produces beat frequencies (e.g. 10 Kc. whistle).

In f.m. systems type (1) is eliminated by limiters in the receiver, but type (2) is still present at the detector. Note that this phase modulation produces indirect f.m. With a 2:1 ratio of desired to unwanted signals, a maximum phase shift of 30 degrees is produced.

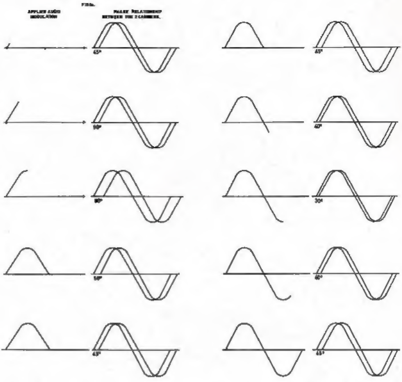


Fig. 6a.—A simplified illustration of Phase Modulation.

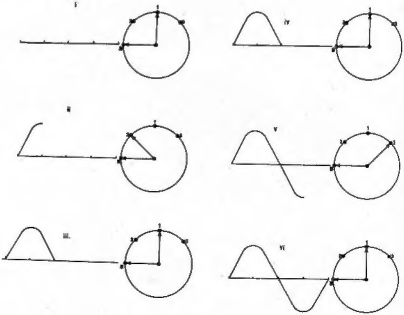
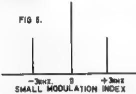


Fig. 6b.

The indirect f.m. cannot be eliminated, but in wideband f.m. systems it can be minimised.

As noted before, the indirect f.m. is directly proportional to the modulation frequency (in cycles) and the maximum phase angle (in radians) of carrier shift.

Now suppose that the interfering signal differs by 1000 cycles from the desired signal and is only half as strong as the desired signal. As noted before, a maximum phase shift of 30 degrees (approx. 0.5 radians) in the desired signal will be produced. The frequency shift (indirect f.m. produced) in the desired signal is in fact 1000 x 0.5 or 500 cycles. The shift is periodically above and below the average frequency of the stronger signal. The frequency variations shift at a rate of 1000 times a second (1000 cycles mod. signal).



If the ordinary f.m. signal is deviated to (±) 15 Kc. then the (±) 500 cycles produced by the interfering signal produces an audio signal greatly smaller than the desired audio signal.

For a S/N ratio of 10:1 this effect is even more marked. Thus the wideband f.m. completely swamps the small indirect f.m. developed from the interference. Herein lies the interference reduction power of f.m.

Note that if the two signals are of the same frequency, no interfering indirect f.m. is produced and the greater the frequency separation of the two signals the greater the amount of interference produced. However, the amplitude will be reduced by the bandpass characteristics of the receiver.

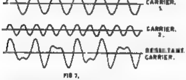


FIG 7.

Fig. 7.—The combination of two carriers to form a resultant which is amplitude and phase-modulated.

DOMINATION BY THE STRONGER SIGNAL

When two signals are comparable in amplitude, the moment one signal becomes even a trifle stronger, the response changes and the stronger signal assumes noticeable control. The process is complete when the ratio reaches the 2:1 point. (For a comparable amount of interference in an a.m. system, a ratio of 100:1 is required.)

Consider two signals of nearly equal amplitude and only slightly different frequency (see Fig. 8).

Let 1 be the stronger signal, 2 be the interfering signal and R be the resultant carrier due to these two signals. As 2 rotates around relative to 1 (different in frequency), R changes greatly in phase but its average frequency is still that of 1, the stronger signal. Hence by bringing the two signals close in amplitude we have produced more phase modulation in the resultant phasor R, but R still follows signal 1, so we hear signal 1 but with some distortion produced by the indirect f.m. caused by signal 2 interacting with 1. If 2 was stronger than 1, then the phasor R would follow signal 2, hence the sharp transition from one signal to the other and this is why the predominant signal assumes control in f.m. systems.

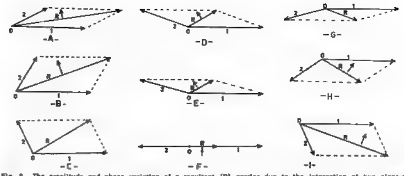


Fig. 8.—The amplitude and phase variation of a resultant (R) carrier due to the interaction of two signals. The small arrows on R indicate whether its phase (with respect to the desired signal, 1) is going in a positive or negative direction.

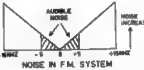


FIG. 9a.

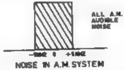


FIG 9b.

NOISE

Consider random noise in the receiver. Interactions between random noise voltages and the carrier also interactions between the random noise voltages produces:

(1) Amplitude modulation of the carrier;
(2) Phase modulation (and thus indirect f.m.) of the carrier.

The amplitude variations are eliminated in the limiters but the phase variations (indirect f.m.) still result in noise.

The amount of indirect f.m. (i.e. noise) is proportional to the frequency difference between the carrier and each random noise voltage, i.e. zero at carrier frequency and increasing directly with increase in bandwidth (see Fig. 9a). Above 5 Kc. we have inaudible noise (considering the response of receiver audio systems). The comparable "noise spectrum" for an a.m. system is shown in Fig. 9b. Note the greater improvement in the amount of noise in the f.m. receiver compared to an a.m. receiver. This can be shown mathematically to be 18.75 decibels or a S/N voltage ratio of 8.65:1.

Let us now consider the effect of reducing the modulation index of the f.m. system. Figs. 10a to 10b to 10c show successive reductions in modulation index until in 10c, with a modulation index of 1, i.e. a comparable bandwidth to the a.m. system, the S/N ratio improvement of f.m. over a.m. is 4.1875 decibels. Hence the importance of obtaining the highest modulation index possible.

PRE-EMPHASIS AND DE-EMPHASIS

It is well known that most of the energy of a voice modulated transmission is contained at the lower audio frequencies, i.e. up to 3 Kc. In addi-

(Continued on Page 24)

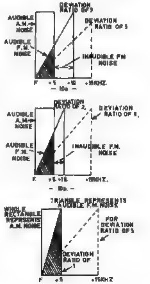


Fig. 10.—Further comparisons between the noise in A.M. and F.M. systems with various F.M. deviation ratios.

Sideband the Expensive Way (how to avoid it)

RODNEY CHAMPNESS,* VK3UG

IT is not uncommon to hear on the air and by other means of some Amateur who has just blown up his nice new Spurious Signal Breather transceiver. What happened? Well it seems that the final tubes melted into a molten mess inside the "well" ventilated p.a. cage. Why did this happen? What are the cures? That is what this article hopes to bring to your notice.

This all started rather slowly, and is a progression of thoughts and realisations over the three years that I have been on sideband. There are a number of things that I will bring to light, that many s.s.b. operators and commercial equipment operators, in particular, seem to ignore. They think either the manufacturer has solved all their problems, or that they, through ignorance or pure laziness and lack of an inquiring mind, have not bothered to think about it.

First, I will start with your tabletop transceiver, which, according to manufacturer's literature, runs 500w. p.e.p. input to a pair of, say, 6KD6 valves. Wonderful what you can get out of these colour t.v. line sweep valves. Wonderful how many watts per cubic inch these miniature rigs run to. Funny thing, though, the case of the transceiver is almost too hot to leave your hand on for long. Ever tried touching the p.a. final valves when they are just running with class AB1 bias and not being driven? You could boil water on them.

The normal p.a. tube in the majority of s.s.b. rigs is run with a standing current which is very little below the allowable dissipation rating of the valve. Then you go and talk the thing up to some astronomic current, not even marked on some popular rigs. Boy, are you then exceeding the dissipation ratings, and how!

As an example, take a 6DQ5. This will run in class AB1 maximum of 750 volts and 280 mA., which works out to a d.c. input of 210 watts d.c. I believe some rigs do run these valves at these figures in AB1 in the c.w. mode. Allowing for a 50% duty cycle still in excess of a 100 watts and the 6DQ5 has only a 32 watt dissipation rating. Class AB1 is rarely much more efficient than about 55%, so this would mean that the 6DQ5 would be dissipating about 47 watts, which is about 50% above maximum ratings. Now sideband runs, according to many, a duty factor of about 30%, so in this case the valve would be just inside its ratings—or would it? No, it is not, as its normal standing current is nearly the maximum dissipation ratings. So once again you are exceeding the ratings unless you use VOX.

Now many loud mouthed Amateurs believe that the rig should read in p.a. current, nearly as much as it should in the c.w. position with the key down. Wow, have you heard their signals? They are the sort of signal that can be tuned as splatter from one end of the band to the other, and I'm not exaggerating, ask Ron Fisher, VK3OM. We experienced a "perfect" example of this one night on 80 metres. To accomplish this high p.a. reading, the audio is turned up, the microphone bellowed into, a compresser and/or pre-amp. fitted and hope to blazes the a.l.c. takes care of this abuse.

The a.l.c. is not designed to act as a speech compressor but more really as an overdrive preventer and splatter preventer. The a.l.c. can only tolerate a certain amount of overdrive, then in most cases glorious splatter emerges. It must also be remembered that there must also be a correct ratio of carrier to audio in the balanced modulator. The audio is considerably weaker, usually by a ratio of about 10:1. If, through your compressor, pre-amp., you decrease this ratio up comes your distortion almost straight away. Once there is distortion in the signal, nothing you can do will effectively get rid of it.

Take pride in the quality of your signal, not how many db. over S9 it is.

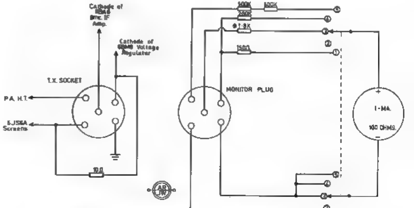
So now it can be seen that by driving your p.a. tubes hard, through either calculated commercial over-rating, or breathing heavily into the microphone system, expensive damage can be done to the p.a. valves. In these small transceivers and transmitters the ventilation is far from adequate, so still more derating of the valves is required. I have extreme doubts that any commercially made Amateur transceiver would come anywhere near the reliability in transmitting time, that a commercial service transmitter would or, for that matter, the old a.m. rig you threw out, when you got this new s.s.b. rig. The 807 in it is still probably the original, and it was still running at least 80% of its new performance.

Well, having dispensed with the preceding causes of poor s.s.b. signals and causes of red hot p.a. tubes, I'll pass onto another perhaps more subtle cause of trouble in s.s.b. transceivers and transmitters

Many months ago I became plagued with a mysterious sudden increase in p.a. current in my Yaesu FL200B transmitter whilst I was talking. I would find that my resting p.a. current would suddenly jump from 60 mA. to about 250 mA. The only way to get it back to normal was to release the transmit button. What was wrong? All sorts of thoughts ran through my mind from grid-cathode shorts, to bias failure, grid emission, ad nauseum.

At about the same time I was also getting intermittent reports of something wrong with my signal. Eventually Ron VK3OM said to me that my signal was f.m.-ing. Horrors, well what could cause this. Variation in v.f.o. h.t. voltage? Yes, this proved to be the answer, but why? The Yaesu uses a rather sophisticated h.t. regulation system which feeds not only the v.f.o. but also the p.a. screens. What had occurred was that I had tuned the rig up ah la book to give the required p.a. current and general expected output level. The way I had loaded the tx was such that the screen current was much higher than it should have been, due to rather light loading of the p.a.

To get the p.a. plate current up, the drive was increased. I went onto speech,



* See text

YAESU FL200B TX MONITOR.

Switch Position 1—Screen current. 0-25 mA.
" " 2—Off
" " 3—A.L.C.
" " 4—Regulated H.T. 0-200 Volts.
" " 5—P.A. H.T. 0-1000 Volts.

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then on speech peaks the screen current exceeded the c.w. level, so causing the voltage regulator to be overdrawn, so loss of regulation. The moment regulation is lost the voltage tends to climb as the regulator requires a higher ignition voltage than maintaining voltage. Speech peak over, the voltage rises as current drain is reduced, but then due to higher voltage on the screens, they draw more current and so do the plates, due to having a much higher screen voltage. The regulator is unable to regain regulation so this destructive situation prevails.

The solution to this problem is fairly obvious. I must load the transmitter so that the screen current is much more reasonable. How can I tell that this current is about right? There is no meter on the Yaesu or to my knowledge any other s.s.b. rig. Anyone who has done some reading about s.s.b. will perhaps vaguely remember something about screen current being observed for tuning a s.s.b. rig final. High s.w.r. readings and slap-happy methods of tuning will cause screen currents to be dangerously high for the tubes. In my experience in commercial s.s.b. transmitting equipment up to about 3kw. d.c. input, this proved quite a problem with reactive aerials. A lightly loaded final, whether s.s.b. or a.m., can almost be considered as being a final in which the plate circuit is open circuit and the screen has the doubtful pleasure of acting as the plate. It attempts to draw currents such as the plate would draw, but due to its structure its dissipation is low and therefore grossly exceeded. The screen gets red, then white hot, and then disintegrates. Exit the p.a.

Notice in the preceding paragraph that I lumped the a.m. and s.s.b. finals in together, in regard to light loading and the effects on the screens. Now you will say if this is so, how come I didn't blow my old 807 up with light loading? The reason is quite simple. Consider the old a.m. final, an 807, with 600 volts on the plate and the screen running at 300 volts fed through a 37,500 ohm resistor from the 600 volt supply. The screen current is 8 mA. Now lightly load the final and the screen attempts to draw say 16 mA., the screen voltage will be a big fat **zero**. So in the case of the lightly loaded a.m. final, the screen current cannot rise much, as the voltage will be reduced to the screen very drastically. The screen is thereby fairly well protected.

Now the case of your nice new s.s.b. final. The situation here is much different. The screen voltage must be regulated for the linear to function in a linear manner. Now with the final lightly loaded, the screen current does rise to this level of 16 mA., using the same set of figures as stated for the a.m rig with the exception of no screen resistor. The screen voltage is regulated and stays the same as with normal loading. We'll load the final more lightly again, more screen current and less plate current. We're well on the way to destroying the final p.a screen grids. We've already got a signal that isn't all it should be in the way of quality.

Well I hope from the preceding information that I have perhaps helped to clear some of the fog which seems to descend when we change from a.m. to s.s.b. The things which were of little importance, so we thought, in the days of a.m. are quite important in regard to proper operation of s.s.b.

Before I finish this article, I will just show you how screen current varies as a function of plate current in my Yaesu tx, and will describe what I call my "Tx Monitor". This device is just a meter with shunts and multipliers so that I can monitor screen current, regulated h.t., p.a. h.t., and a.l.c. With 300 mA. h.t. current drawn by the p.a., I find that loading the final so that a screen current of 8 mA. is drawn gives best results, with my FL200B tx.

The following table should give you some idea of how screen current escalates with increased drive levels, such as when the gain is turned up full bore (p.a. tune and loading left untouched):

PA Current	Screen Current CW	Screen Current SSB
100 mA.	0.5 mA.	Approx.
150 mA.	1 mA.	double c.w.
200 mA.	2 mA.	reading for
250 mA.	4 mA.	same p.a.
300 mA.	8 mA.	current.

Table for two 6JS6A valves in parallel in Yaesu Musen FL200B.

"TX MONITOR"

Now to the "Tx Monitor". This was built into a plastic case 6" x 3½" x 2¼", available from "A.R." advertiser. The meter is a 1 mA. movement of the MO-65 style. The switch was an ordinary Oak MSP 2-pole 5-position single bank switch. The unit is attached via a five-core cable to a miniature 5-pin plug which fits a miniature 5-pin McMurdo socket on the rear apron of my transmitter.

The transmitter wiring modifications are self evident from the diagram. The metering ranges are as follows (1) screen current, 0-25 mA.; (2) no connection; (3) a.l.c. (no levels marked), (4) regulated screen voltage, 0-200v (normal 150 volts); (5) p.a. h.t., 0-1000 volts (normal 600v.).

The 150 ohm resistor presupposes that the meter resistance is 100 ohms, so making up a total of 250 ohms. The 1.8K ohm resistor is subject to experiment to get full scale reading in the a.l.c. position with no modulation. It may need to be higher or lower in value. Unless you use 1% resistors in all positions, you may need to play around with the exact values to get correct readings.

This is shown as made to suit my Yaesu tx but could be easily adapted to suit any transceiver or transmitter. I find this little unit to be an extremely handy accessory to my transmitter. I would not think now of tuning the rig without monitoring both the p.a. plate current, or actually cathode current, and separately the screen current. I know a little more with this monitor about what is going on inside and find this most rewarding, and I might add I haven't blown up any p.a. valves yet. This unit is part of my insurance that I don't.

I would recommend for your reading the various articles that have been in the s.s.b notes which appeared a few years back. Most were written by VK5NN. A recent article in "A.R." which bears close study is the one appearing towards the end of 1968 by VK2AOU. This gives excellent data for anyone wanting to build or just perhaps to understand a little more about this mysterious mode many use, called s.s.b. Mysterious, because few really understand much about its finer points, and I'm one of those who has got a lot to learn yet.

SWAN NEWS LETTER

Swan Electronics are now rapidly expanding their operations into other products and to further this end they recently purchased the well known antenna company of HORNET ANTENNAS.

This now gives Swan a full range of very sophisticated antennas for both commercial and amateur operation. These antenna are now known as Swan Hornet antenna and cover multiband beams, both full sized and shortened; trapped vertical, all band; trapped dipole, and mobile whip types.

As the Swan factory distributor for Australia, W.F.S. Electronic Supply Co. will shortly have stocks of these very fine antennas; the following types will be the first to be available.

TB1000-4	FOUR ELEMENT TRIBAND BEAM	1000 WATTS
TB1000-3	THREE ELEMENT TRIBAND BEAM	1000 WATTS
TB750-3	THREE ELEMENT TRIBAND BEAM	750 WATTS

W.F.S. ELECTRONIC SUPPLY CO.

12 BOWDEN ST., NORTH PARRAMATTA, N.S.W., 2151. Ph. 630-1621

also **SWAN SERVICE, 14 Glebe Street, Edgecliffe, N.S.W., 2027. Phone 32-5465**

Conversion of Circuit Diagrams to Veroboard, Tag-Board and Printed Circuit Layout*

A. T. CAMPBELL, G3PEQ

WE have all had the frustration of wiring up a circuit from a diagram, painfully trying to avoid errors and to miss nothing out. Then after a quick check through, the circuit has been connected to power—and it hasn't worked. Frequently more time is now spent in finding and correcting the fault than was occupied in the actual construction.

The method I am going to describe avoids all this. It enables the layout to be achieved automatically, except for printed circuit boards where a **little** thought is required. Checking is easy and thorough, and can be done systematically on paper without the need for poking about among a complex of wires and, according to Murphy's Law, missing the one thing one is looking for.

Normally one traces through a part of the circuit, taking the components involved one by one and connecting them, one hopes, to the right places. Let us forget all that, relegate the components to a secondary position, and concentrate on the junction points. We will illustrate this with a simple one-transistor amplifier which we will lay out for Veroboard construction.

VEROBOARD

Fig. 1 shows seven junction points, for the negative and positive lines can be considered as extended points, as shown in Fig. 2. It does not matter how we number these points, except that it is advisable to number the leads of the transistor in the same order as they emerge from the case so as to avoid twisting them, with risk of breaking off or shorting when we insert the transistor. In the diagram I have not put in the value of the components, but have lettered them in order to make reference easier in the following descriptions.

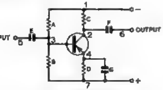

Fig. 1.—A simple amplifier

After a little practice, you can now immediately wire up the circuit; but until experienced, it is well to go through the following stages, first laying out on paper and then checking.

On a sheet of paper, draw seven lines, numbering them from 1 to 7 to correspond with the junction points of Fig. 1 (see Fig. 3). Now proceed to draw in the components; you may do so in the literal order, A to G, to avoid the possibility of missing any; or, if you have any spatial imagery, insert them in the order which will waste least space, which is what I have done here.

Taking then the resistor A, we note it is connected between 1 and 3. Mark clear dots on lines 1 and 3, join them with the resistor symbol and label A (in practice, of course, with the actual value). C is connected between 1 and 2 in the same way, and the capacitor F between 2 and 6. Now mark in the transistor at 2, 3 and 4, indicating either the collector or emitter; if you have labelled the transistor leads consecutively you need label nothing else

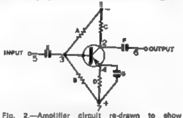

Fig. 2.—Amplifier circuit re-drawn to show positive and negative rails as points.

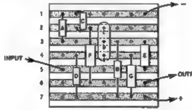

Fig. 3.—Veroboard layout of the amplifier

because the leads will automatically come in the right place. Similarly we mark in B, D, G and E and indicate four points for the connection of input, output and power. It does not matter, of course, at which end of the lines you mark these last four points; you suit your own convenience entirely.

The layout is finished; checking must begin.

Quick Check: Count the number of components on the diagram and layout. If these do not agree, find the error. If they agree, refer to point 1. There are three connections at this point; there should be three dots on line 1. At point 2 there are three connections and again three dots; at point 3 there are four connections and should be four dots; and so on for the remaining junction points. This is a sufficient check in most circumstances, but you can, if you wish, proceed to the:

Certain Check: Consider component A; one end is connected to C and the negative line; the other to B, E and the base of the transistor. Check that these connections actually take place in the layout diagram, and proceed to check each component in the same way; finally checking that positive and negative lines, input and output are correctly connected. If everything tallies, you cannot be wrong!

Cut a piece of Veroboard to size. Select the components required and check them thoroughly. This is a point often overlooked (through laziness!) and causes more trouble than anything else. You can spend hours looking for a wiring fault, when it is a component that is faulty, or wrong value. Resistors are easily verified with a test-meter, but if you have no method of checking capacitors, which are much more likely to be faulty, build yourself a capacity bridge; it will repay the time spent on it over and over again. Measure at least the forward and reverse resistances of the transistor diodes; but if you are using it in, say, a phase shift oscillator circuit, you must measure the gain also—a simple thing to do with a quick hook-up.

Having checked components, label the rows of Veroboard in some way to show the numbering. A strip of gummed paper may be stuck on, or a piece of Sellotape-X, or they may be marked with a reed pen or a grease pencil. Do not omit this, unless you are less fallible than I am! Now bend the leads to fit into the right holes, remembering that the vertical positioning of resistors is often a great help; clean the leads where they will make contact with the foil, bend them over, cut off, leaving about ⅛" of wire, and solder. Conclude by soldering in either pins or wires for the connections to power, input and output and mark them with a piece of gummed paper, grease crayon, or other means

You have finished and **you can't be wrong!**

Now let us tackle a multi-vibrator used as an audio oscillator. The snag here is that as both transistors have a common connection to the emitter, we cannot number the leads consecutively, but we get over this by numbering the collector and base of TR1 as 2 and 3 and follow immediately with TR2 numbered 4, 5 and 6. Then the emitter of TR1 will also go to 6, the length of the leads normally being more than enough to do this. So Fig 5 becomes the layout of Fig. 4.

In anything more complicated than these two simple circuits, one difficulty sure to occur is that the number of junction points is greater than the number of stripes of copper available. To cope with this we break a number of strips at one or more points to provide the requisite number of connections, obviously choosing strips for breaking which have only a small number of connections going to them. If

* Reprinted from "Radio Communication," July 1969.

the strips are carefully numbered on the Veroboard, no difficulty in connection can arise If much Veroboard work is done, a spot face cutter should certainly be acquired as it saves much work and makes a good job; but if this is lacking, a 3/16" twist drill rotated in the fingers will break the strip easily and cleanly.

It may be found advisable, in order to get a leadout in a more suitable position, to break a short strip where required for the leadout and connect with a link of insulated wire to the point it derives from. The same method can be adopted if the lead of TR1 is not long enough to reach to strip 6. This, and many other useful dodges will quickly be realised as soon as you have laid out and built one or two Veroboard circuits.

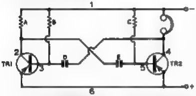

Fig 4.—A multi-vibrator as an audio oscillator

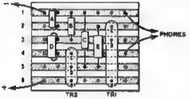

Fig 5.—Veroboard layout of the oscillator

I was so pleased with the above method of construction that I built several dozen small and large pieces of apparatus, quite satisfied that this was the ultimate in building methods. But gradually disadvantages from the experimenter's, rather than the builder's point of view began to appear. The experimenter wishes to change components to examine the effect of varying values, and to make measurements from different points of the circuit. Neither of these is easy with Veroboard construction. For these purposes, tag-board construction has many advantages; but in my opinion, it is ungainly in appearance; one seldom has the right size of group-board available, and connecting up and checking is a tedious procedure The last of these difficulties disappeared on a little reflection, and an adaptation of the methods used for Veroboard made layout and checking completely straightforward. How to get over the difficulty of the awkwardness of group-boards?

TAG-BOARD (OR GROUP-BOARD)

The first approach was to drill paxolin sheet to take turret tags in the required positions and thus to build up a tailor-made group-board. The result was pleasing and satisfactory, but time-consuming. The method I invariably use now is to build up my group-board with soldering pins on plain Veroboard, achieving quick construction and one which looks really well when finished and in which the components are more securely fixed whilst at the same time they can be easily removed and changed, and measurements are quickly made from any required pin.

The most convenient board I find is the Lektrokit Chassis Plate No. 4, LK-141, obtained from Home Radio at 3/- each. These are approximately 5" x 4" and contain 40 rows of 35 holes spaced 1/10" apart. Each will provide three 20-way group-boards or half a dozen or more smaller ones. The soldering pins are sold in packets of 100, their ordering number being LK-3011. The plate is most easily cut with a pair of side-cutters; if each edge of the plate is cut with them at the required spot, the whole separates neatly.

But let us first deal with the layout, then the construction. For convenience, we will use the circuit of Fig. 1 for our design.

The first step again is to number the junctions, but this time we need pay no attention to the transistor leads, but may number them in any order we like. However, to save another diagram, we will use the same numbering already on the figure.

There are eight components, so we draw an 8-way group-board, as in Fig. 6, then draw in the symbols for the components. It will ease wiring if we group together components connected to each other, so we begin with the components associated with junction point 3, where there are four leads connected. Note that it is perfectly easy to insert another pin for the base connection of the transistor, so we do so, offsetting the base pin towards the emitter to prevent error when we come to put the transistor into circuit. The top (or bottom) ends of E, A and B are labelled with their number, 3, and the other ends will be 5, 1 and 7 respectively, and the transistor 2, 3 and 4.

Fig. 6.—The amplifier arranged for group-board.

The other components are drawn in, keeping together so far as is possible those connected to each other, and numbering the ends in the way which seems likely to need least wiring. Follow all this in Fig. 6.

The complications of wiring reduce to one simple rule: join all the corresponding numbers! I use a red pen for this, but I have no doubt it will be reproduced in black.

One thing remains to ease our work; take a piece of tracing paper and trace the tags and joining wires and then reverse the paper. This is how the wiring will appear on the back of our group-board.

Checking is as with the Veroboard. Take point 1, observe what is connected in the circuit diagram and check that they are all wired together on the tag-board. Checking each component similarly can be done if thought necessary, but it is a work of supererogation

Take a piece of plain Veroboard and with the fingers insert the pins as in Fig. 6. I leave one space between each pair of pins and seven spaces between the two rows, giving a width of 0.9", which is about right for ½ watt resistors and miniature capacitors, but you may, of course, modify the spacing as you wish. Having inserted the pins, take a pair of small pliers and press them in firmly, keeping the heads at a uniform height above the board

Reverse the board and wire up Tinned copper wire 26 s.w.g. is just right for this; it is easy to work and sufficiently rigid for there to be no danger of the loops 1 and 7 touching each other if bent away in the first place. When there appears a danger of wires touching, slip a piece of sleeving over one of them.

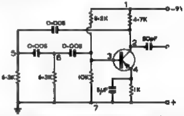

Fig 7.—A phase-shift oscillator Unmarked units are kilohms or microfarads

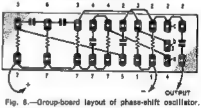

Fig. 8.—Group-board layout of phase-shift oscillator.

If you are ultra-cautious, restore the board to its original position and with an ohm-meter check that the pins are connected as in Fig. 6. This should reveal any dry joints.

Nothing remains now but to check all components (yes!) and solder them into position as in Fig. 6.

The method is fool-proof—but I admit there are fools **and** fools!

I think one should refrain from connecting components across the board between separated tags, as is a very common practice, but there are times when a departure from this rule can be advantageous. A good example is the phase-shift oscillator, Fig. 7. Here connecting the two 0.005 uF. capacitors between the ends of the resistors (see Fig 8) is obviously economical of space, time and wiring and by allowing two spaces between tags 5, 6 and 3, instead of the usual one on the plain Veroboard, the fitting-in of the components becomes physically easy.

If you build this phase-shift oscillator, don't forget you **must** use a high-gain transistor to overcome the attenuation introduced by the three phase-shift circuits.

PRINTED CIRCUIT

And so we come to what many regard as the ultimate in lay-out dif-

ficulty—the printed circuit. Using our methods, this involves no more difficulty than the other layouts, but does require a little thought and care in arrangement.

Turning again to our audio amplifier, Fig. 1, we first evolve the tag-board layout of Fig. 6. This obviously cannot be used as it stands for a printed circuit as two leads cross, but it is a simple matter to re-arrange them as in Fig. 9, from which is immediately derived the printed circuit of Fig. 10. Place a piece of tracing paper over Fig. 10, trace it, reverse the paper, mark through on to the copper foil of the printed circuit and you are all set for etching, drilling, etc.

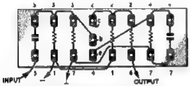

Fig. 9.—The group-board wiring of the simple amplifier modified for printed circuit.

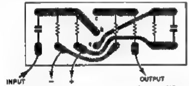

Fig. 10.—Printed circuit for simple amplifier.

Similarly the circuit of the phase-shift oscillator first becomes the tag-board of Fig. 8 and is then easily transformed into the printed circuit of Fig. 11.

With a complicated circuit you may easily find that the avoidance of crossing wires involves a complicated circumperambulation all over the board, or is altogether impossible. This may be sometimes cured by a simple re-arrangement of the components; but a very simple, and always certain, cure is to solder a link of insulated wire between the two points to be connected.

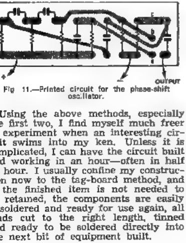

Fig. 11.—Printed circuit for the phase-shift oscillator.

Using the above methods, especially the first two, I find myself much freer to experiment when an interesting circuit swims into my ken. Unless it is complicated, I can have the circuit built and working in an hour—often in half an hour. I usually confine my construction now to the tag-board method, and if the finished item is not needed to be retained, the components are easily unsoldered and ready for use again, all leads cut to the right length, tinned and ready to be soldered directly into the next bit of equipment built.

JOE

A. J. C. THOMPSON,* VK4AT

People appear to think that staid people like myself should be playing bowls instead of taking up Radio. They even ask for details of the events that led up to the decision of selecting such an unusual hobby

Actually those circumstances occurred in my far distant youthful days. It has just been the fear of doubts being cast on my veracity that has kept me quiet for so long.

Being home from College on holidays at one time, it was rightly assumed that I knew all about electricity. It was no surprise to me that I was chosen by some vegetable-growing foreign-born citizens to explain the mysteries of an electric fence that they had recently acquired. These things were mysteries to all at that time, including myself.

Having mastered Ohms Law and the art of throwing switches, little things like electric fences would be nothing to me.

In a dignified manner I ushered the bashful foreigners into my sanctum.

In a truly professional manner I soon had the cover off.

I remembered then that our College instructor spent a lot of his time warning the unruly members of our tribe on the danger of going up in smoke if we placed our fingers here and also there

It appeared to be quite a good take-off point. The language difficulty gave me an opportunity to air my French.

"You touchee here, you touchee there, muchee blue sparksie go upski, muchee corpsey plonk go downski."

Charlie appeared surprised at my knowledge of foreign languages, but Joe grasped eagerly at the only word that evidently he understood. He tapped his red shirt all smiles, "Blue Blue".

I patiently explained to him that it was only in France that blue was red. It was evident, at this stage, that the language business was going to be tough.

I tried a new tack. I connected up the gadget to the battery according to the instructions and off it went, tick, tick. I pointed to the little spark on the points, but they made it clear that they desired big sparks.

I remembered then that our teacher lined the whole class up, and then put a little tingle through all our fingers as we held hands. He used a little gadget that looked like this.

A couple of 6-inch nails made good handles when the bare wires were attached from the two output terminals. Joe held one and I had the other, while I held his hand to make the circuit. Before I switched it on, I decided that it was a pity to leave Charlie right out of things.

After a bit of thought, I decided to improve on the College method. I could let Charlie observe the spark at the same time as Joe felt the tingle. I explained to Charlie, who evidently understood our language, that, instead of holding Joe's hand, I would, instead, make the blue spark go on to his ear from my fingers. This would be at a convenient height where we could observe it easily

All being set, I approached Joe's ear with my finger, while Charlie and I pressed close to see how far the spark would jump. Joe, with a happy smile, cocked his eyes sideways in the hope of seeing the tip of his ear at the crucial moment

When I closed the switch things happened quickly. To our astonishment (mine was much different to Charlie's), Joe's ear disappeared upward, with Joe still attached to it. When he came down again he lay on the floor muttering.

Charlie tended him. Mystified, I asked Charlie what Joe was doing down there? Charlie shook his head: "Too muchee blue sparksie". Joe still muttered.

"What is he saying now, Charlie?"

"Him say him understand corpsey now. Him head hit the roof, but him feet stay on floor."

Patiently I explained to Charlie that we ourselves had seen Joe ascend and descend all in one piece. I explained that if I had been holding Joe's ear then he might quite easily have lost it.

At this stage, Joe started threshing around.

"What is biting Joe now, Charlie?" I wanted to know.

"Him want looking glass" was the unexpected reply.

However his wants were easily supplied, but his behaviour was peculiar. Instead of looking at the bump on his head, he was examining himself all over. He even got Charlie to hold the mirror while he rolled over. He then studied his back.

Curiosity got the better of me. "What is he doing that for Charlie?" I asked. The reply explained all.

"Him very worried man. Him afraid him turn round before him head get back on"

We got Joe up and soothed down, but he would not stay. He felt all right but he thought he would just walk home.

Just after he had left, my fond parent arrived with suitable refreshments. She observed Joe's stately walk with some astonishment, then asked Charlie, "What is Joe doing walking like that? And why is he holding his head with both hands?"

Charlie's reply completely mystified her. "Him hold him head on for fear him head fall off again"

These events impressed me greatly It was quite natural that I should take up Radio after witnessing the strange effects of such electrical gadgets.

I often wonder though if Joe took up Radio too.

* Skyring Creek, Pomona, Qld., 4568.

HIGH VOLTAGE REGULATORS

RODNEY CHAMPNESS, VK3UG*

THE majority of high voltage regulators seem to use either the old 807 or 6AS7 valves, the first being a rather high impedance valve and the latter a rather expensive valve. There is nothing that could be called new in either of the two regulators that are described below. The first one (Fig. 1) is rather simple and as long as you can stay within the dissipation ratings of the valve currents of up to 75 mA., voltages up to 220 volts d.c. can be obtained, so saving on using series parallel banks of VR tubes for some applications

The larger regulator (Fig. 2) can supply voltages up to 300 volts at currents up to 200 mA., and with the possibility of even being able to supply currents up to 250 to 280 mA. with the substitution of other series losser valves

The 6GV8 is a t.v. vertical section valve and has characteristics such that at rather low screen voltages of below 150 volts, it can draw currents up around 75 mA. without the grid approaching closer than a few volts of zero grid bias. The grid bias must at all times remain negative in this and the larger regulator, otherwise regulation ceases.

Consider the operation of the triode section first. The unregulated voltage is supplied through a ½ meg. resistor to the plate. The grid will be at earth potential if the slider is at the earth end of the 50K pot. The NE2 neon lamp will tend to light and will assume a voltage drop somewhere about 60 volts, so the cathode of the valve will be 60 volts positive to the grid and the valve will be cut off. The pentode section will then receive positive grid voltage via the ½ meg. resistor, causing this valve to conduct heavily, which will mean that the cathode will be about the same potential as the grid However, this will not be the same as the unregulated h.t. as the grid current will cause a voltage drop across the ½ meg. resistor

If now the slider across the 50K pot. is removed from the earth end of the travel to mid travel, so that the slider is sampling about quarter of the voltage present at the pentode cathode, the regulator will now be operating. As the cathode of the triode is at about 60 volts positive, the grid will be about 55 volts positive in approximate figures and drawing a certain amount of current which will be causing the plate voltage to settle at about 200 to 215 volts, depending on the current being drawn from the regulator. This voltage is applied directly to the grid of the pentode and the cathode will assume a voltage from 5 to about 15 volts more positive, depending on current drain, so giving the pentode a negative bias of this amount The cathode will be approximately at 220 volts due to the voltage divider arrangement in its cathode circuit If the slider is at the top of the pot., it will be sampling half the voltage of the output to the triode grid, which will still be at about 55 volts and so the cathode of the pentode will now assume about 110 volts positive, as its grid will be about the 100 mark, plus or minus a few volts depending on the current drain.

Now assuming the pot. is set such that an output voltage of 200 volts is obtained at 5 to 10 mA., the triode grid will be about 55 volts and the triode plate pentode grid will be about 185 volts. Now the load is increased to say 60 mA., the output voltage will tend to drop, causing the voltage on the grid of the triode to drop, so causing it to conduct less and the plate voltage to rise. As the pentode grid is directly connected its grid voltage will rise or its negative bias will become less, causing the valve to conduct more and so restore the original output voltage. This output voltage can also be maintained at a constant voltage with variations in the unregulated supply voltage input.

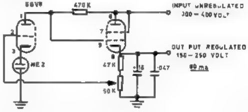

FIG. 1 60 Ma. REGULATED SUPPLY.

The main things to remember with this simple supply are that the minimum difference voltage between the unregulated input, and the regulated output, should be at least 120 volts and that the current is not to exceed 75 mA. and that the output voltage is not to exceed 220 volts, unless the heater of the valve is supplied from a separate supply, as the cathode-heater maximum voltage rating is 220 volts. The plate dissipation rating of 9 watts should not be exceeded

The resistor potentiometer in the pentode cathode circuit can be altered to suit a specific design need. The unregulated supply input will determine to a certain extent the output voltage The NE2 neon can be replaced with a zener diode of about ¼ watt rating, 60 volts, or nearest convenient voltage. Using a zener in the cathode will mean that the output voltage will drop should the current drain be such as to cause the pentode to draw grid current. As soon as the excess load is removed, the supply will resume normal operation

With the neon lamp, however, this is not the same If the pentode draws grid current, the neon will drop out of conduction and the voltage drops. If the load isn't dropped much below overload, the voltage will then go high by perhaps 40 to 50 volts. As the neon requires perhaps 90 volts to ignite it, the plate voltage will not rise enough, as the pentode will still be drawing grid current because of this "new 90 volts" reference voltage causing the supply to think it has to supply 50% more output voltage. With this higher output voltage, more current is drawn by the supplied unit and more or less locks the regulator out of regulation. For this reason a zener diode reference source is preferred.

As a point of interest, f.m. caused on one variety of s.s.b. transmitter is from this reason. The transmitter is incorrectly tuned, causing excess screen current to be drawn by the screen on speech, the regulator goes out of regulation, sometimes staying out as the screen draws high standing current when the voltage jumps to 200 volts from 150 volts. The v.f.o. is on the same 150 volt line, so is it any wonder that the v.f.o. jumps around in frequency. The regulator doesn't always lock out and the result is a beaut case

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Manuscripts should preferably be typewritten but if handwritten please double space the writing. Drawings will be done by "A.R." staff.

Photographs will be returned if the sender's name and address is shown on the back of each photograph submitted.

Please address all articles to the
EDITOR "A.R.,"
P.O. BOX 36,
EAST MELBOURNE,
VICTORIA, 3002.

* 24 O'Dowds Road, Warragul, Vic., 3820.

of f.m. How to cure this? Tune the transmitter properly.

Now we turn to the larger of the two supplies (Fig. 2). This is designed around t.v. line output valves such as the 6CM5 in this instance, although I feel a 6DQ6 could be better due to higher plate dissipation. The reason for the choice of these particular valves in preference to the old and trusty 807 is simple The screen of the series losser is virtually connected to the plate, the 807 requires about 300 volts for it to draw reasonable current, but the likes of the 6CM5 require only 100 volts or a little more between plate/screen and cathode to draw identical currents. This simply means that with an 807 as the series losser, an unregulated input of about 600 volts will be needed for a 300 volt output, whereas with the 6CM5 a 400 volt unregulated supply could be sufficient. This is considerably more economical on power and cost of the necessary transformer iron.

of 100 volts, so be warned! There is no worry in regard to the 6AU6 cathode-heater rating as the voltage is only about 60 volts across these two, which is well below the allowable maximum.

Layout of parts for the supply is not critical, except to make sure the losser valves have adequate ventilation.

Considering that the 6CM5 valves are only rated at 13 watts each, the estimated current drains must be calculated so that the valves are not ruined. With 400 volts input and 300 volts output, we have a drop of 100 volts. This means that W (watts) = I (current) × E (voltage); in this case W is 26, E 100, therefore I is 26 ÷ 100 = 260 mA. maximum current. With an output voltage of 200, however, I = 26 ÷ 200 = 130 mA. maximum current. In between voltages will mean different output currents.

Using 6DQ6A valves which have a 5 watt higher dissipation, will mean at the lower voltages more current can be drawn. In the case of 200 volt output, the current maximum is 180 mA., although I feel these particular valves are rather conservatively rated and you may, with experimentation, just to see how they take it, try them at 200 mA. on 200 volts. I've seen some of these 6DQ6A valves take a thrashing in s.s.b. linears, and have run personally 80 watts c.w. to one without an ounce of trouble. This was with the unit running into dummy load for minutes on end with the key down and not a sign of red gills. The 6CM5 and 6DQ6 have identical pin connections, so can be interchanged with little trouble.

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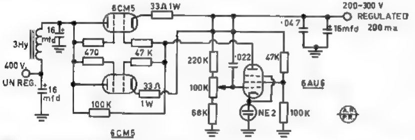


F.G.2 200 Ma REGULATED SUPPLY

There are a few noticeable differences between this larger supply and the smaller one. It will be noticed that the screen and grid of both series losser 6CM5 valves have stoppers in their leads. This, strange as it may seem, is absolutely essential in many cases, particularly when two valves are paralleled. Even though this is a supposedly d.c. circuit, these valves take off very effectively at all sorts of odd frequencies, up to at least the 14 Mc. band, and the regulation just doesn't work. The 33 ohm resistors in the cathodes of the two series lossers is for current equalisation, so that both valves take approximately the same current. Without these resistors, one slightly seedy 6CM5 would let its fellow take most of the current and go red in the face.

The 0.022 uF. capacitor from regulated output to regulator control grid (6AU6) is designed to inject some hum from the regulated output into the regulator circuit to improve output voltage filtering. Another way of achieving the same thing is to break the 100K ohm resistor between the 6CM5 plates and the 6AU6 plate into two 47K ohm resistors with an 8 uF. capacitor connected to the junction of the two resistors and the other end to earth.

The only other point to note is that for 6CM5 valves, or whatever valves of this type used, a separate filament supply will be necessary that is not tied to ground, as the heater-cathode rating of these valves is only of the order

This article on voltage regulators will perhaps help some to get away from the feeling that banks of VR tubes are necessary to handle large voltages and currents. Both supplies work quite well although I feel currents in excess of 200 mA. may cause poor regulation at high output voltages with the large supply and no higher than 75 mA. in the case of the smaller, although 60 mA. may be a safer figure for best regulation.

A variant of the smaller supply is used quite a bit in some Yaesu Musen equipment. The larger supply is an adaption of a supply published in Radiotron Designers Handbook.

One very desirable feature of these types of supplies is that you are not tied to a definite regulated output voltage as by just varying the position of the slider on the voltage control potentiometer, a reasonable range of output voltage can be obtained.

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries Where totals are the same, listings will be alphabetical by call sign

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	316/340	VK5AB	297/314
VK6RU	313/338	VK4KS	287/302
VK3AHO	311/326	VK4FJ	284/304
VK4HR	309/328	VK4TY	284/288
VK3JZ	306/324	VK2APK	277/283
VK6MK	303/325	VK3TL	271/277

New Members:

Cert. No.	Call	Total
102	VK2AXI	103/108
103	VK4SD	114/115
104	VK3LC	107/107

Note: Cert. No. 102 shown last month should read VK2AXI not VK4SD.

Amendments:

VK2AAK	270/275	VK4UC	199/199
VK3ZE	237/240	VK3AMK	185/186
VK3ACD	233/235	VK4RF	155/155
VK4PX	216/217	VK3SX	145/148
VK4MY	202/202	VK4SD	114/116

C.W

VK3AHQ	301/315	VK2APK	274/282
VK2QL	300/323	VK3YL	271/288
VK3CX	289/312	VK3XB	270/287
VK4FJ	288/314	VK3ARX	269/278
VK4HR	285/307	VK6RU	266/289
VK2AGH	282/296	VK3NC	263/286

Amendments:

VK3RJ	248/260	VK4RF	135/147
VK4MY	152/158	VK4PX	104/106

OPEN

VK6RU	314/339	VK6MK	304/324
VK4HR	313/338	VK2EO	302/325
VK2AGH	312/332	VK4FJ	297/322
VK3VN	308/325	VK2APK	294/305
VK4SD	306/321	VK3ARX	292/301
VK4TY	306/321	VK4KS	286/307

Amendments:

VK3NC	264/287	VK4MY	226/226
VK4UC	246/247	VK4RF	199/211
VK3ACD	232/236	VK3SX	154/157
VK4PX	232/237		

The W8NWU Teeter Totter Tuners*

JOHN J. SCHULTZ, W2EEY/1

> ● The author's article on T Networks in the "CQ" issue of May, 1968, resulted in correspondence with various Amateurs who developed T Network designs. One of the most interesting variations on the theme of T Networks was W8NWU's series of tuners.

THE original article on T networks mainly emphasised their low-loss possibilities and their application in matching relatively short antennas on the low frequency bands

W8NWU found a much wider application possible for this handy network, including usage at v.h.f. frequencies where the components for other networks may become trickier to adjust. He also found various inexpensive sources for the components that could be used in a variety of the lower frequency versions of a T network.

THE BASIC TEETER TOTTER

Fig. 1 shows the basic T network which was named the Teeter Totter. If both the input and output impedances are the same, the value of both capacitors will be the same at resonance. When the output impedance is greater than the input impedance, the value of the capacitor in the output leg will decrease to match the higher impedance at the output while the value of the capacitor in the input leg must increase in order to keep the combination of the two capacitors and the coil in resonance. When the output impedance is lower than the input impedance, the opposite setting of relative capacitor values is necessary. This seesaw action of the capacitor values resulted in the Teeter Totter name.

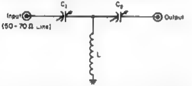


Fig 1.—Basic Teeter Totter version of a T network.

The circuit was tried on 80 through 2 metres. The range of impedances that can be matched depends upon the tuning range of the components used, but it will cover at least 4 to 1. That is, with a 50 ohm input reactive impedances from at least 12 to 200 ohms can be accommodated.

A typical circuit for use on 80 metres was constructed using a 20 uH. coil and two 140 pF. variable capacitors. The unit was constructed in a small aluminium enclosure using the components that were available from a surplus BC375 tuning unit. Although no power tests were tried, it would seem that the spacing of these capacitors and the heavy coil would allow operation with even a kw. rig. Fig. 2 shows the construction used

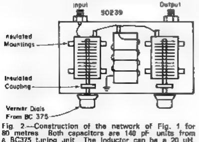


Fig. 2.—Construction of the network of Fig. 1 for 80 metres. Both capacitors are 140 pF. units from a BC375 tuning unit. The inductor can be a 20 uH. unit air wound from 1/8 inch copper tubing or wound on the ceramic form in the BC375 tuning unit, double spacing all but four turns at one end of the ribbed form.

CIRCUIT VARIATIONS

In order to eliminate the need for having to insulate the two variable capacitors from ground, the circuit of Fig. 3 was developed. Basically it works the same as the circuit of Fig. 1 except that it is a half-wave instead of a quarter-wave circuit. The proportionate amount of inductance in each leg varies according to the impedance ratio being matched while the impedance at the point where the variable capacitor is connected remains infinite. The range of impedances which can be matched is again at least 4:1.

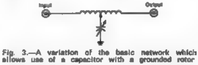


Fig. 3.—A variation of the basic network which allows use of a capacitor with a grounded rotor.

A simple procedure is possible to initially determine the coil and capacitor values. Both ends of the coil instead of being connected to any external circuit are grounded, each through a 50 ohm resistor (for use in a 50 ohm co-axial line at the input) The capacitor is placed at the centre of the coil. Then a grid dip oscillator is loosely coupled to the coil and tuned to the band of interest. The coil is symmetrically dimensioned and the capacitor value adjusted for resonance. The resistor representing the output load can be replaced by different values and the resistive range which the circuit can match determined as the components are resonated again for each different load value.[1]

Fig. 4 shows the construction of such a tuner for use on 80 metres. The contact on the roller inductor must be modified to permit a separate lead to the variable capacitor. By removing the two t.v. doorknob capacitors, which are in series, from their parallel connection to the variable capacitor, the same component values will work on 40 mx.

Low power versions of the circuit, particularly for use on 10 metres, have been constructed using XR-50 coil forms and 25-50 pF. receiver type variable capacitors. Such a circuit constructed in a minibox would be particularly useful, for example, at the base of a fixed station or mobile vertical antenna which didn't present an exact match to the type of co-axial line that was available. When the impedance transformation was not too great, as it would be when going from a 30-36 ohm whip base impedance to a 52 or 70 ohm co-axial line, no re-tuning of the circuit is necessary over any major segment of a band. Instead of a variable capacitor being used, the slugs in the coil form could also be used for tuning and a fixed 47 pF. mica capacitor used.

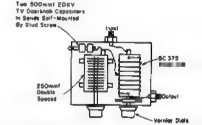


Fig. 4.—Construction of network of Fig. 3 for 80 or 40 metres utilising mainly BC375 components

MULTIBAND VERSIONS

Multiband versions of either form of the network can be constructed as shown in Figs. 5(A) and 5(B). Which circuit is best is a moot question and the choice must be left to the individual builder. Each circuit has various constructional advantages and disadvantages. The circuit of Fig. 5(A) requires two insulated capacitor mountings but the dissipative losses in the capacitors may be less than in the inductors of Fig. 5(B) The arm of the inductor bandswitch can be grounded thus lowering its insulation requirements. The single capacitor of Fig. 5(B) is certainly easier to mount on a chassis. However, the insulation requirements of the inductor bandswitch, if it is mounted on a metal panel, may be rather high when a high impedance is being matched at the output.

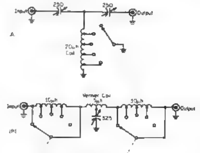


Fig. 5.—Two methods for constructing bandswitched couplers. Typical values are shown which should allow complete 80-10 metre coverage. Coil taps must be found by experimentation for each band.

* Reprinted from "CQ," February, 1969.

[1] You may use a low power exciter and s.w.r meter to the network's input.

AUSTRALIS OSCAR 5 PROGRESS REPORT

RICHARD TONKIN*

The launching into orbit of the **Australis Oscar 5** satellite has been delayed by problems with the launch vehicle with which it is hoped the satellite will hitch a ride into space. However, it seems likely that the launch will occur before the end of the year. Latest launch information may be obtained by listening to the weekly W.I.A. Divisional broadcasts.

AMSAT have now completed the pre-launch tests on the satellite, which have been under way since May. The satellite has passed the rigorous vibration and thermal vacuum tests very successfully and it is now considered ready for launch.

A problem which arose in the command receiver ("A.R." November 1969, page 19) has now been at least partially corrected and it seems likely that the 29.450 Mc. transmitter will be switched **on** at about 0700 GMT each Friday and **off** at around 0700 GMT each Monday. This, of course, will conserve the satellite's chemical batteries and will enable both transmitters to operate for a longer period.

Final alignment of the satellite's transmitters resulted in the following power outputs:

29.450 Mc. transmitter	180 mW.
144.050 Mc. transmitter	120 mW.

These power outputs will gradually decrease as the battery runs down. It is expected that the 2 metre transmitter will operate for about six weeks and the 10 metre transmitter for more than eight weeks (at week-ends only).

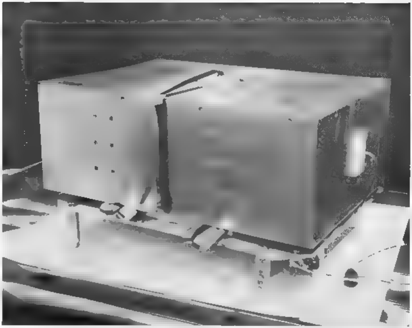
Amateurs and S.w.l's intending to track the satellite should read the following articles which have appeared in "A.R.":

Australis Oscar "A"—Users' Guide, February 1968, page 3.

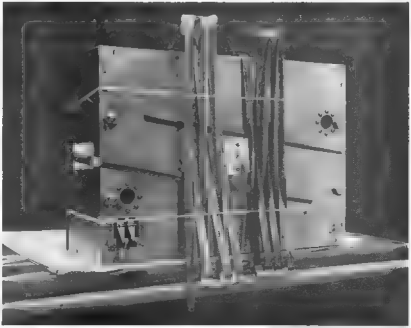
Australis Oscar "A"—Users' Guide, Part Two, March 1968, page 10.

Australis Oscar 5 Satellite Ready for Launch, Oct 1969, page 7.

The telemetry calibration graphs which appeared in the October 1969 issue of "A.R." are the ones which should be used by those tracking the satellite. Additional copies of the calibration graphs, telemetry reporting forms and information on when to listen for the satellite may be obtained from the Oscar State Co-ordinators, whose names appeared on page 7 of October 1969 "A.R."



The Australis Oscar 5 Satellite in launch configuration.



Antenna folding pattern.

* Chairman, Project Australis, 5/29 Tooronga Road, East Malvern, Vic., 3145.

OBSERVATIONS FROM AUSTRALIS OSCAR 5*

JAN A. KING, K8VTR

While tracking a satellite is an important and interesting Amateur activity, it is far from being the main objective of **Australis Oscar 5**. This is a telemetry satellite and reports information about itself as well as its environment, the former is useful to designers of future satellites and the latter gives data for ionospheric propagation and space research. Project Australis-Oscar and AMSAT need this information from every Amateur listening to the satellite. Some suggestions for observations are given below

1. **Acquiring the satellite**.—Generally, listen for the 2 metre beacon before trying the 10 metre beacon, which may be **on** intermittently or only during week-ends. Observe telemetry channel 1 to see if the 10 metre beacon is **on**; a current of 50 to 60 mA. (during the first month of operation) indicates the beacon is **on**, while 25 to 30 mA shows it is **off.**

2. **Temperature record.**—Keep an accurate record of the temperature (channels 5 and 7) during each part of a pass Overhead passes will occur at your location around 1500 local time every day. Data for these and other passes is of interest for the thermal designer of future satellites. Of great interest is the temperature during the North-South pass at 0300 local time daily, when the satellite will be going through a dark (colder) period. Another useful measurement is the difference in temperature between the skin and inside of the space craft.

3. **Horizon sensor.**—This experiment is a first for Amateur Radio. Three horizon sensors are mounted on the satellite with the following alignment:

X axis sensor—parallel with the 2 metre antennas.

Y axis sensor—perpendicular to all antennas.

Z axis sensor—parallel with the 10 metre antennas.

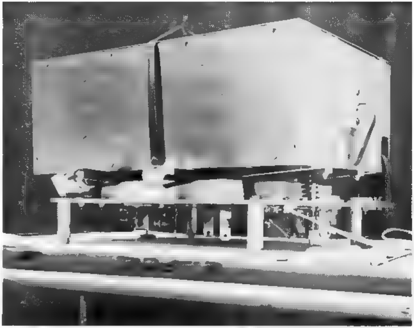
When a sensor is not viewing the earth, the telemetry channel emits a tone between 510 and 640 cycles; when it views a portion of the earth, the tone will be higher, probably around 1000 to 1200 cycles. Measure these values for each axis and add them to your telemetry report

A word of caution If the satellite spin rate is high about a given axis, one or two sensors may have an **on** time shorter than the duration of the sampling period In this case, be careful not to confuse the **on-off** transition with a telemetry channel change. Probably the spin rate around the Z axis will be slow (about 4 r.p.m.), but confusion may sometimes arise even at this slow rate

Occasionally a short transition may occur on one of the sensors as it sweeps across the sun or the moon Note the

(Continued on Page 24

* Reprinted from "AMSAT Newsletter," October 1969.



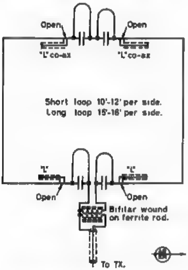
Satellite on separation plate Note separation spring

Vibration test configuration

Photographs by courtesy of National Aeronautics and Space Administration

More on the Single-Loop, Triband Cubical Quad Beam Element

Experiments have shown that the energy transfer from the feedline to the radiator quad element can be greatly improved—especially on 10 mx—if a simple ferrite transformer is installed between the lower pair of tuned circuits. The ferrite is a 2" long ½" diameter rod, like those used for balun transformers. Three turns each bifilar and tightly wound insulated wire of sufficient gauge for the power used are wound on to the rod.



DJ2UT used with excellent results the following version: The coils are replaced by wire loops and the capacitors are formed by pieces of open ended co-axial cable. The radiator loop has 15 feet and the reflector 16 feet per side, this larger loop gives of course more gain and less "L" is needed for the tuning coils or loops. With the larger loop it was necessary to have a similar set of tuned circuits at the bottom and at the top of each quad loop, to prevent the radiation lobe on 10 metres from showing to one side.

The same tuning units were also used by him with a **small loop**, by extending it **with four pieces of co-ax**. (the far end short-circuited) instead of loading coils near the tuning units.

JA1BHG described in the JA Amateur magazine the translation of my "A.R." paper and his successful experiments with several forms of the single loop quad. Dimensions and s.w.r. graphs were published. Sorry, I can't read the JA text.

—H. F. Ruckert, VK2AOU.

PROVISIONAL SUNSPOT NUMBERS

AUGUST 1969

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	175	16	46
2	182	17	35
3	161	18	32
4	174	19	29
5	158	20	23
6	134	21	30
7	126	22	46
8	96	23	62
9	105	24	66
10	90	25	75
11	73	26	90
12	60	27	96
13	47	28	107
14	50	29	124
15	62	30	138
		31	114

Mean equals 90.2.
Mean for February 1969: 107.6.

Predictions of the Smoothed Monthly Sunspot Numbers

November	93	January	90
December	92	February	89

—Swiss Federal Observatory, Zurich.

PROVISIONAL SUNSPOT NUMBERS

SEPTEMBER 1969

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	81	16	107
2	78	17	110
3	73	18	110
4	67	19	69
5	63	20	49
6	69	21	63
7	63	22	65
8	63	23	85
9	40	24	86
10	45	25	112
11	64	26	115
12	67	27	123
13	63	28	110
14	75	29	88
15	105	30	81

Mean equals 81.0.
Smoothed Mean for March 1969: 105.3.

Predictions of the Smoothed Monthly Sunspot Numbers

December	87	February	84
January	85	March	82

—Swiss Federal Observatory, Zurich.

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Transistors on Computer Boards—Some Further Thoughts

R. L. GUNTHER, VK7RG*

IN Part 1 of this series ("A.R." Aug. 1969) were described the approximate electrical characteristics of the transistors which have been found on computer circuit boards. It is possible that other types will be discovered, but those were the only ones we saw, out of many thousands examined. In the following discussion, I shall investigtae related topics in somewhat more detail.

ILLEGIBLE NUMBERS

From time to time the number designation has been rubbed off the top of a transistor. There are several ways to meet this problem.

(1) Compare the board with others. If an identical configuration of parts is found, numbers may be read from the other board.

(2) Do a few simple tests: PNP/NPN, BV_{EBO} v. BV_{CBO}, BV_{CER}. That will tell you the polarity, whether the transistor is alloy junction (e.g. 033, 083) or alloy diffused (e.g. 015, 065), and whether it is likely low power (e.g. 033) or medium power (e.g. 030).

(3) At the worst, if you don't know the number, it won't matter in most instances, as long as you know the polarity. Most transistors are 033, 083, or similar, and you are not likely to be wrong if you make that assumption. If application is other than that of "general purpose" type, tests could be useful, depending on specific characteristics required. For properties such as low noise or high voltage or high gain, individual testing is necessary in any event.

BREAKDOWN VOLTAGES

There is no need to panic when you see apparently obscure designations like "BV_{CBO}" and related parameters, this is the shorthand of transistor voltage designations, and as we discussed in Part 1, they can be very useful to untangle the voltage rating behaviour of a transistor under various conditions. The main points to be made are these: If resistance in the base circuit is relatively high (e.g. over a few kilohms for ordinary types), the collector breakdown voltage drops sharply, finally ending at BV_{CEO} with infinite base circuit resistance Unfortunately, there is so much variation in BV_{CER} between individual transistors, there is no way to forecast this behaviour except by testing each unit, if voltage rating matters

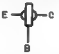
Another point is that voltage rating may matter more often than you believe. If there is an inductive load, collector voltage can rise to alarming levels, particularly if the collector current is pulsed, e.g. in Class C, or even in Class A if the transistor is overdriven on a peak. A peak, that is all it needs if you are too close to BV_{CE}. Take note.

* 32 Waterworks Road, Dynnyrne, Tas., 7005.

The other point where voltage matters is the problem of overdriving amplifiers in Class C; I have discussed this at length in the series on transistor transmitter design in late 1967 issues of "E.E.B.", and in "Amateur Radio" (Sept. 1967, p. 14), and there is no need to go into it further here. But bear in mind that you cannot, without impunity, crank up the drive on a transistor as you would a valve, particularly if the base is already back-biased (even by a base-leak). If you don't believe this, try it on an 015 or 065 with various values of drive and bias; this can be illuminating, and it can also give you a feel of the limits to which you can push these transistors. It is practical in this instance because of the unusually low cost of these items.

These germanium transistors can resist transients somewhat better than silicon, because of their relatively sloppy reverse characteristics, but there is more latitude among the TO-5 case types than in the TO-18 (small) case ones. Owing to their low leakage and high impedance characteristics, the TO-18 types are often as sensitive to overvoltages as silicon; I have punctured them with as little as 3 μA. of reverse current, collector to base. They are best tested by constant-current methods, as described in "E.E.B." for May 1967

Perhaps you may be interested to know why the BV_{EBO} characteristics of the alloy junction (e.g. 033) types differ so much from all the others. It is caused by the symmetrical arrangement of the collector and emitter dots on the base chip; this causes about the same breakdown level on either side:



The other types all have better frequency response and a much lower base-emitter than collector-base breakdown. This will also be evident from the construction of the diffused alloy types:

This geometry reduces transit times, depletion layers, etc., and improves frequency response greatly. The mesa types are similar, but with part of the collector chip etched away. Planar add further degrees of sophistication; I must write an article about this one day for "A.R." or "E.E.B."

There is a peculiar property transistors show when there is a very high resistance in the base circuit. As collector-emitter voltage increases, the collector current will increase sharply at BV_{CEO}, as one would expect, but it rises faster than it ought. If the power supply is current limited (as with a large resistor), the collector voltage will be seen to increase and whereas collector current increases, the collector voltage will **decrease.** If you continue to increase I_{CR}, second-breakdown will occur, and the junction will vanish. But between these two points, the collector shows a negative resistance characteristic. It seems reasonable to assume that this occurs because, with no external current possible to the base, leakage from the collector forward biases the base, increasing collector current, thereby lowering collector voltage. This property has been put to practical use with computer transistors for an oscillator in a signal injector circuit,[1] and many applications suggest themselves. A similar effect (though for different reasons) can be observed just beyond the zener point of some diodes, allowing them to be used as oscillators! This may be verified quite simply while testing reverse characteristics of a batch of diodes, if you place a small transistor radio near the testing power supply. As you pass the zener voltage, some diodes will cause a noticeable series of squawks or buzzes at r.f., presumably from a kind of tunnel-diode action in combination with distributed inductance and capacitance of the power supply circuit.

On a more serious level, the whole phenomenon of second breakdown is well covered in the "R.C.A. Silicon Power Circuits Manual," beginning on p. 84.

EFFECT OF HEAT ON FREQUENCY RESPONSE AND BETA

Although some of us who were involved with testing these transistors are not wholly in agreement, it is possible that the spread of f_T actually found has been made large by adverse effect of heating while desoldering—or through circuit abuse. This would have the effect of lowering the apparent minimum. Rather, I should say the actual minimum, since once the frequency response has been degraded, the change is permanent

In any event, we have definite evidence that excessive heat can introduce instabilities, and lower punch-through voltage and impedance. If, then, you want to preserve optimum operating characteristics of the transistors, the minimum possible desoldering heat should be employed. Preferably, high frequency transistors should be removed from boards by sawing them out, leaving some of the printed circuit wiring attached for easy connection. If sufficient board is included with the transistor, it can also provide a simple means of supporting or mounting it.

Beware, therefore, of claims that "circuit board transistors can stand a lot of heat". They can, but may suffer in some respects even though they still

1. "E.E.B.," June-July 1967.

amplify Indeed, a strange result is that they may amplify even better! (at low frequencies). I performed a number of tests in which transistors were forced to dissipate about 5 watts for several seconds The result was that the alloy diffused types increased their d.c amplification factor (β) from 10% to 50%, but the alloy junction types were apparently unaffected. An increase of β, so obtained, was permanent, but slightly too much heating could degrade it suddenly Presumably the heating decreased the frequency response while increasing the d.c. amplification factor. Amazing!

ACTUAL HIGH FREQUENCY PERFORMANCE

The figures given in the Tables of Part 1 of this series were mostly obtained (by an engineer friend) from actual measurements of f_T, by measuring the slope of h_{FE} with f above $f\alpha_E$. It seemed to me, however, that a practical way to evaluate the high frequency performance of a transistor would be to use it in an actual circuit. The simplest way to do this is to make the transistor part of a feedback oscillator. The maximum frequency of oscillation may be taken as a guide to the upper limit of performance of a given transistor. It may amplify up to that frequency, but it certainly won't amplify much beyond it under ordinary experimenters' conditions, because the transistor oscillates in the first instance only because it still amplifies. You can assume that an ordinary Hartley or Colpitts configuration will give the maximum practical amplification/oscillation frequency for a given transistor connected in common-emitter configuration. The maximum practical frequency for a transistor in common-base is suggested by the maximum oscillation frequency of a common-base oscillator,[2] assuming good geometry for both. I take the liberty of reproducing here (Fig. 1) a circuit which has been used[2] for this purpose. When C1 is large (e.g. 100 pF.), the oscillator behaves like a tapped-coil type. When C1 is minimum, the oscillator is essentially parasitic, or common-base type with feedback only via the internal capacities of the transistor Further details of theory and use may be read in the "Break-In" article, which, incidentally, will be re-printed in "E.E.B"

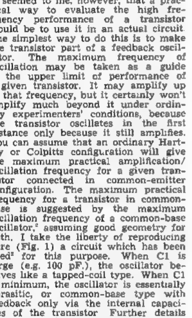


Fig. 1—Transistor frequency testing oscillator L/C should be high for best response C1 See text.

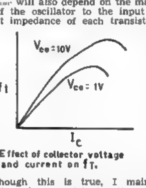
2—"The Common-Base Oscillator, and its Applications," by C. P Smith, VK2CD, and R. L Gunther, VK7RG, "Break-In", March 1968, p 45.

I have called the maximum oscillation frequency so obtained, "f_{osc}". It is not necessarily equivalent to f_{MAX}; the latter is the maximum theoretical frequency at which a transistor will amplify, i.e. when power gain is unity. Because of the usual circuit inefficiencies, P.G. was much likely higher than that for maximum frequency of oscillation here. I did, however, find an apparent relationship between f_{osc} and f_T, as shown in this chart:

Type	f_T* Mc.	f_{osc}* Mc.	F %
Mesa	100-300	25-100	25-40
Alloy diffused	40-100	25-45	25-50
Alloy junction	≈4-20	5-20	80-150

(* At 5V./2mA.)

Here, $F = f_{osc}/f_T$. If F were constant, this relation might allow you to find f_{osc} or f_T if one were known. f_T will be constant for a given type of transistor, within the production limits. But f_{osc} depends not only on f_T, but also on base resistance and collector capacitance. Since each of these can vary widely from one transistor to another, our engineer friend maintains that there is no great value in finding values for F. In addition, he points out that f_{osc} will also depend on the matching of the oscillator to the input and output impedance of each transistor.



Effect of collector voltage and current on f_T.

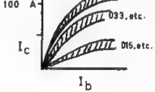
Although this is true, I maintain that there is a consistent pattern of F for a given transistor type, as shown in the above chart, and that f_{osc} is a useful parameter because of its obvious practical value.

From the chart it may be seen that F is about the same for the first two types, but that f_{osc} is about the same as f_T for the low-frequency ones. This has practical value, because it shows that appreciable performance can be obtained even from the "low frequency" types (compare with OC71!), and that the oscillator performance of the high-frequency transistors is not as impressive as the range of f_T appears to indicate. Indeed, the TO-18s appear to be only slightly better than the TO-5s at I_C = 2 mA., even though the f_T of the latter is considerably higher. It is quite possible that this was caused by inadequacy of design of my test oscillator, but again this is the actual, not the ideal situation, therefore useful for you.

On the other hand, it is essential to realise that frequency response of a transistor depends on collector voltage and collector current. This may be seen readily by observing the gain-bandwidth product curves of various transistors. Owing to the varicap properties of the junctions, f_T increases with voltage, and increases to a maximum with current. The latter behaviour is well illustrated by the curves of Fig. 2 of the preceding article; f_T of a given type 153 went up from 270 Mc. at 1 mA. to 500 Mc. at 5 mA., and likely even higher at 10 mA; for that same transistor f_{osc} was 240 Mc., just about the limit of my absorption wavemeter (used to measure the frequency of the test oscillator)

Since the average power dissipation limits of the TO-18 mesa types must not be exceeded, it is evident that their best response will be obtained under pulsed operating conditions (10-30 mA.), not surprisingly the condition found in computers. It would also apply to Class C, but most of the 20-18 types have too low a voltage rating for effective use in transmitter stages. They will work well indeed in receiver and instrument applications, and best with moderately high currents, as long as they do not become too hot. But they are best in their use as switches.

Conversely, because of the relatively constant f_T (with I_C) of the TO-5 alloy diffused types (015, etc.), they are not suitable for high speed switching in computers, because they saturate at low currents (e.g. 20 mA.), although they make good high frequency amplifiers. The alloy junction types (e.g. 033) do not saturate until currents of 100 mA. or so are reached, but their transient-response time is not good enough for use in switching circuits; they make lovely amplifiers, though. Unfortunately, data books do not always stress this difference between switching and amplifier behaviour, and even professional engineers can make the wrong choice (or so I am told by a professional engineer).



In summary, f_{osc} will often be a better guide to actual performance of transistors in a real circuit, than will f_T, though one must remember that it does depend on V_C and I_C, and that amplifiers may oscillate better than they will amplify at some high frequency—a fact which is well known to all students of Murphy's Law.[3] The performance of the amplifier will also be highly dependent on geometry, neutralisation, and unilateralisation This matter has been discussed in 1967 issues of "E.E.B" and will be the subject of a forthcoming article in "A.R." Under optimum conditions, a rule of thumb would say that the maximum useful common-emitter frequency (e.g. P.G — 10 db.) will be found at quarter to half f_T, depending But this is only useful if you know f_T.

3—If something can go wrong, it will!

SPREAD OF CHARACTERISTICS

Our engineer friend suggests that one reason for the wide variation found within a given type may be that some of the transistors developed faults during use, which made them unsuitable for computer use. After all, that is likely one of the reasons why the boards have been declared surplus in the first instance. It is possible that "typical" values lie above the pessimistic minima we have shown, and the results of our averages imply this. But again, the fact remains that these minima are the real values encountered by the experimenter stripping the boards. A transistor which may be degraded[4] for computer use may be perfectly satisfactory for an experimenter, for many applications—as long as he is not building a computer!

In any event, the wide spread of characteristics within a given type makes nonsense of any attempt to specify commercial equivalent types. There is a superficial resemblance between the alloy junction types and the 2N1302-9 series; and alloy diffused types and 2N1300-1, 2N1654 or 2N1683; and the mesa types to 2N705, 2N711, 2N971 or 2N1204. The situation, however, of the connection of collector or base to case, and the fact that it is difficult to find adequate agreement with an average of important parameters, leads us to believe that these are special computer transistors manufactured specially for the purpose.

Since there is often more variation of characteristics with a given type number than between type numbers, and since these transistors appear to be special types, there seems little point in trying to find a specific type number that they can replace. The only sane procedure is to ascertain the principal characteristics of a transistor in a given circuit, and then choose computer board transistors which match it most closely. Those characteristics may be found from the various data manuals, or simply by circuit inspection; in an ordinary low power audio amplifier, virtually any of the transistors will work, having the correct polarity. In a circuit amplifying 1 Mc., the alloy junction types will suffice; for 10 Mc., the alloy diffused types; for 100 Mc. at low voltage, the small mesa types; above that use commercial transistors.

Even the difference between silicon and germanium is not always large. It may alter the bias requirements a bit, but this is easily done. In base-stabilised circuits, the germanium would need about one-quarter volt less base voltage than silicon. If the bias was not altered, the effect would be to increase the collector current of the germanium unit somewhat

It is not really necessary to dwell on this matter of replacement, but I mention it only because I am constantly approached by desperate young men who must know "what shall I use to replace the transistor in this circuit; I can't buy it locally?" They look startled when I say that "it probably does not matter". In view of the fact that in any handful of transistors you pick up, most of them will work in most circuits, it is truly depressing that manufacturers continue to issue their plethora of type numbers, each differing infinitesimally from the last.

TESTING TRANSISTORS

Throughout these pages we have insisted that the data charts can only be approximate guides to characteristics and that optimum use of a given transistor can only be obtained if you test it. If you test it, you will be able more effectively to design it into a circuit, by the simple rules of the excellent design articles which have appeared in "A.R." and elsewhere.

The extent of your tests will depend on your applications. For a simple LT AF oscillator you can probably take it as-is, without testing (though trouble-shooting is facilitated if you know at least that you are starting with a good transistor). For critical h.f. work, a frequency test is desirable; use the oscillator of Fig. 1, and measure its maximum frequency with an absorption wavemeter (or with a g.d.o. if the test oscillator is just beyond the maximum frequency). For h.t. power supply or r.f. power amplifier work, a voltage test and possibly BV_{CES} test is indicated, particularly if there is appreciable resistance in the base circuit to be used. For a.f., a gain check can show you the best transistors to use when high gain is desirable in a stage (high gain isn't always necessary).

One important property of transistors is often overlooked when testing; the amplification factor (e.g. β) can vary appreciably with different values of collector current; the more linear is the characteristics, the less is this variation (viz., shallower slope, $d\beta/dI_C$). This behaviour is most clearly visualised by examining h_{FE} v. I_C curves from various data sheets, and in lesser degree, from the curves in Part 1 of this series. Therefore, it is better to test a transistor at the current at which it will actually be used, than at some arbitrary level (usually 1 mA.). The conventional 1 mA. figure may be all right for ordinary lower power types, but it tells you nothing about intermediate (2N1038 or 028) or high power (2N301, 036, 042, 2N1100) types. In addition, it may be useful to know the actual linearity of a transistor—as when choosing for units to go into a low-distortion amplifier.

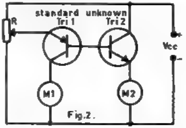


Fig. 2—Simple transistor gain tester (by L. J. Yelland). For low power transistors, R can be 5K, smaller for higher power. Vcc at least 6v., preferably same voltage as used for test transistor in actual application.

A very clever and useful device for making such tests simply has been suggested by L. J. Yelland, of Melbourne, to whom I am grateful for the circuit of Fig. 2. Tr1 is a standard transistor whose gain is known as a function of collector current (a calibration curve as in Fig. 3 can be kept at hand). Tr2 is the transistor under test. Note that the two transistors must be opposite polarity, but same type (e.g., germanium, same power range, etc.). Where I_1 is the current read on M_1, and I_2 on M_2, R is adjusted until I_2 is at the desired level, whence

$$h_{FE2} = (I_2 \div I_1)\ (h_{FE1})$$

or

$$h_{FE2} = I_2\ (h_{FE1} \div I_1).$$

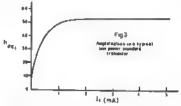


Fig. 3.

This avoids the nuisance of having to measure very small base currents, and measures gain at actual current levels desired, quickly. A calibration curve of gain v. current should be made for each standard transistor, e.g. Fig. 3. From this should be made a plot of ($h_{FE1} \div I_1$) v. I_1, as in Fig. 4 (merely an example, please note). From the right hand form of the above equation, it may be seen that the d.c. current gain of the unknown transistor (No. 2) can be obtained simply by multiplying I_2 by the fraction obtained from a Fig. 4-type plot. Indeed, for simple general tests, where I_2 is taken at a standard 1 mA., the gain of transistor 2 may be read directly from the ordinate.

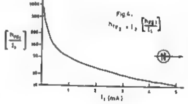


Fig. 4.

I should like to express my appreciation for the help and insights received from R. W. Brown, VK7ZRO, R. S. Maddever of Geelong, Vic., and our engineer friend who has been so patient and helpful.

4—C.f. "E.E.B.," May and June 1967, Sept. 1968.

CHANGE OF ADDRESS

W.I.A. members are requested to promptly notify any change of address to their Divisional Secretary —not direct to "Amateur Radio."

Burglary at VK2WI (Dural) and also at Crows Nest

The New South Wales Division's station at Dural was burglared some time on Thursday night, 23rd October. It would appear that the burglary was done by person or persons with an intimate knowledge of the station and its equipment.

Set out below is a list of items stolen. If anyone knows anything at all regarding the present location of any of this equipment, or if anyone is offered any of the equipment, they are requested to contact Gordon Clarke, Divisional President, by Phoning 94-2353 (work) or 94-6598 (home).

Any information will be handled with the strictest confidence.

1—Pye 30 watt a.m. v.h.f. Transmitter Type P.T.C. 330N, Reference No. 28444G, Serial No. 113. With Type D Crystal for 53.866 Mc.
1—Pye a.m. v.h.f. Receiver Type P.T.C. 3002N, Reference No. 284451, Serial No. 136, with Type D Crystal for 53.866 Mc
1—Kingsley Type AR7 Communications Receiver, Serial No. 1177, Chassis No. 02626, with "D" band coil box and 2 metre converter
1—Kingsley Type AR7 Communications Receiver, Serial No. 245B/S1746, Chassis No. 01407, with "D" band coil box and 80 metre converter
6—Coil boxes for Kingsley Receivers.
3—Power Supplies for Kingsley Receivers, 250 volt a.c., 12v. d.c.
1—829B transmitting valve.
2—Quartz Crystals Type D, frequencies 3247.916 Kc. and 11190.0 Kc.
2—Quartz Crystals Type 5587 holders, frequency 3525 Kc.
2—Quartz Crystals Type 5587 holders, frequency 3573 Kc
1—Bendix Frequency Meter, Type BC221
1—S.W.R. Meter, "2WI" stencilled on case.
1—Philips Cathode Ray Oscillograph, "2WI" stencilled on case.
1—A.W.A. Portable Beat Frequency Oscillator, "2WI" stencilled on case, Type 4R7490, No. 386
5—Co-ax. Cable Connectors, Type PL259.
1—Desk Microphone and Control Box with pilot light and push button.
1—Palec Valve Testing Set.
1—Multimeter.
2—Pairs Headphones with plugs and cords.

The N.S.W. Division suffered another blow on 12th November, 1969, when the offices at 14 Aitchison Street, Crows Nest, were broken into and the following equipment stolen:

1—Hallicrafter Communications Receiver, Model SX111, Serial No. 1110109/23168.
1—R.C.A. Communications Receiver, Type AR88. No serial number
1—Paros Transceiver.
1—only 522 transmitter, no serial number. Mounted on 19 x 9 inch blue metal panel.
1—only 522 Transmitter and Receiver in black case
1—Adcola Soldering Iron, 240 volt.
1—A.W.A. Type MR10B Carphone with 240v. a.c. power supply
155—2N3819 Semiconductors.
8—V.h.f. Pre-amps.
2—Six Metre Converters.
75—TIS88s.
150—TT3564s.
40—2N3055s.
50—NJ480s
7500—Resistors.
Call Books, Log Books, P.M.G. Handbooks, and coil formers.

AUSTRALIS OSCAR 5

(Continued from Page 19)

time, particular sensor, and tone frequency when this happens. Also note if the signal is in a null or a peak at the time. You may like to compute the exact attitude of the space craft and to correlate it with the signal strength and polarisation of the two beacons.

The X axis sensor data can be used to assess the effect of the magnetic attitude stabilisation system; the X axis spin rate should gradually decrease during several days as the axis comes into alignment with the geomagnetic field.

4. **The propagation experiment.**—The 10 metre beacon operating at 29.450 Mc. is potentially **Australis Oscar 5**'s most important source for scientific information. It also requires greater sophistication on the part of the Amateur.

To fully participate it will be necessary to track both beacons simultaneously and preferably to record them on magnetic tape or paper charts.

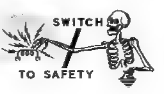
Estimate the time when you expect to acquire the satellite and start listening several minutes beforehand. Note the time difference between acquisition of the two signals (2 metre and 10 metre). Similarly, note the time difference between loss of signals. Note any anomalies.

Using the 2 metre signal as a reference, try to time correlate the 10 metre signal to it. Make corrections for any pointing errors with either antenna. Discount the fairly regular nulls in signals caused by satellite spin.

An interesting number to be reported would be S_{10}/S_2, i.e. the ratio of signal strengths at 10 metres and 2 metres, measured in linear units or in db. Compute this ratio for as many points during a pass as possible. Compare it with similar passes on other days. Does it stay particularly large or small during certain periods? Check for other Amateur activity at 10 metres affecting the observed signal.

The S_{10}/S_2 observations assist in the analysis of ionospheric effects at the two wavelengths. In addition, try to observe antipodal reception by listening for the 10 metre signal when the satellite is on the exact opposite side of the earth from you. Such observations should be well documented and reported to Project Australis

5. **Other experiments.** — The above list is not comprehensive. Imaginative Amateurs will certainly think up many new experiments. If you have any ideas or suggestions, please send them in. Remember, your participation is essential to the continuation of an Amateur satellite programme.



THE F.M. SYSTEM

(Continued from Page 9)

tion, it has further been brought to light that the greatest irritating noise generated is located from 3 Kc. up. To reduce the effect of this noise, a pre-emphasis network is inserted in the audio section of the transmitter. Its purpose is to boost the frequencies above 1 Kc.

At the receiver there is a de-emphasis network to reduce frequencies above 1 Kc. to their original values. The overall effect is a return of the signal to its proper relative proportions, but with a considerable reduction in noise.

FIG.11.

Fig. 11.—Improvement in noise reduction due to pre-emphasis circuit in transmitter

Another beneficial effect of de-emphasis is concerned with the noise produced by another signal or the ever-present random noise.

As previously noted, the greater the difference between the carrier frequency and the interference, the greater the indirect f.m. produced. By the use of the de-emphasis network, the triangular response of Fig. 10 is modified to the trapezium of Fig. 11. The de-emphasis action, by reducing the level of all frequencies above 1 Kc., slices off a considerable portion of the noise.

I trust that this article has been able to shed some light on the rather neglected subject of the theory behind the f.m. system and it will enable Amateurs to speak with a little more authority about the effects observed in their equipment.

INOUE IC-700

My quest, in Japan, was for modern high quality Amateur equipment of very good value. INOUE is selling in Japan, England, Germany, U.S.A. and elsewhere. The IC-700 Transceiver covers all Amateur bands from 3.5 to 29.7 Mc. in 500 Kc. segments with 1 Kc. read-out; plus WWV (10 Mc.). Using 9 Mc., 2.4 Kc. filters in both rx and tx, this single conversion design is free of unwanted spurious. Sensitivity is better than 1 uV. for 10 db S+N/N ratio. Operates on a.m. or c.w. (500 c. bandwidth) and s.s.b

BOOMLESS QUAD

Identical electrical spacing on 20, 15, 10. **Centre Castings** c/w. bolts $10 pr **Canes** 16-18 ft, $1.25 ea $8 per set **Fibreglass** 11.5 ft. long $9 ea. **Kits** triband, complete (castings, canes, wire and nylon line) $30.
Prices include Sales Tax. Freight forward

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Phone 45-3002

JOHN MOYLE MEMORIAL NATIONAL FIELD DAY CONTEST, 1970

SATURDAY, 7th FEBRUARY, TO SUNDAY, 8th FEBRUARY, 1970

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian Amateurs and Short Wave Listeners to participate in this Annual Contest, which is held to perpetuate the memory of John Moyle, whose efforts advanced the Amateur Radio Service.

There are two divisions of this Contest, one of 24 hours continuous duration, and one of 6 hours continuous duration. The six-hour period has been included to encourage the operator who is unable to participate for the full 24-hour period. The 24-hour continuous operation is to be chosen by operator from 26-hour period.

Operators using 25 watts or less input to the final stage will be considered for a certificate where his activity warrants its issue.

DATE

From 0600 GMT, 7th February, 1970, to 0800 GMT, 8th February, 1970.

OBJECTS

The operators of Portable and Mobile Stations within all VK Call Areas will endeavour to contact other Portable/Mobile and Fixed Stations in VK Call Areas and Foreign Call Areas.

RULES

1. There are two divisions, one of six (6) hours, and one of twenty-four (24) hours duration. The six-hour period for operating may be chosen from any time during the Contest, but the six-hour period so chosen **must be continuous.** In each division, there are six sections:—
   - (a) Portable/Mobile Transmitting, Phone.
   - (b) Portable/Mobile Transmitting, C.w.
   - (c) Portable/Mobile Transmitting, Open.
   - (d) Portable/Mobile Transmitting, Multiple Operation, open only.
   - (e) Fixed Transmitting Stations working Portable/Mobile Stations, open only.
   - (f) Reception of Portable/Mobile Stations.

2. All Australian Amateurs are encouraged to take part. Operators will be limited to their licensed power. This power shall be derived from a self-contained and fully portable source.

(a) Portable/Mobile Stations shall not be situated in any occupied dwelling or building. Portable/Mobile Stations may be moved from place to place during the Contest.

No apparatus shall be set up on the site earlier than 24 hours prior to the Contest

All Amateur bands may be used, but no cross band operating is permitted. Cross mode operation is permitted

Entrants in Section (d) for Multiple Operator Stations can set up separate transmitters to work on different bands at the same time. All such units of a Multiple Operator Station must be located within an area that can be encompassed by a circle not greater than half a mile diameter.

For each transmitter of a Multiple Operator Station a separate log shall be kept with serial numbers starting from 001, and increasing by one for each successive contact. All logs of a Multiple Operator Station shall be submitted by the operator under whose Call Sign the transmitters are working. No two transmitters of a Multiple Operator Station are permitted to operate on the same band at any time.

3. Amateurs may enter for any section.

4. One contact per station for phone to phone, also one for c.w. to c.w. per band is permitted. Cross mode operation will be accepted for scoring.

5. Entrants must operate within the terms of their licences and in particular observe the regulations with regards to portable operation.

6. The exchange of serial numbers, consisting of RS or RST report plus three figures, commencing with 001 and increasing by one for each successive contact by the VK Station, shall be proof of contact.

7. **Scoring—**

(a) **Portable/Mobile Stations:**
- For contacts with Portable/Mobile Stations outside entrant's Call Area .... **15 points**
- For contacts with Portable/Mobile Stations within entrant's Call Area .... **10 points**
- For contacts with Fixed Stations outside the entrant's Call Area . **5 points**
- For contacts with Fixed Stations within the entrant's Call Area .... **2 points**

(b) **Fixed Stations:**
- For contacts with Portable/Mobile Statons outside entrant's Call Area .... **15 points**
- For contacts with Portable/Mobile Stations within entrant's Call Area .... **10 points**

8. The following shall constitute Call Areas: VK1, VK2, VK3, VK4, VK5, VK6, VK7, VK8, VK9 and VK0.

Example of Victorian S.w.l's Log

Date Time (GMT)	Band	Call Sign Heard	RST No. Sent	Station Worked	Points Claim
7/2/70 0600	80 mx	VK2AAH/P	58001	VK3ATL/P	15
GMT 0610	80 mx	VK3ATL/P	58006	VK3QV	10
0620	40 mx	VK2AAH/P	589004	VK6VF/P	15
0640	20 mx	VK3QV	58010	VK5QX/P	*
0900	20 mx	VK4OF/P	59040	VK4OX/P	15

* No claim Fixed Station.

9. All logs shall be set out under the following headings: Date/Time (G.M.T.), Band, Emission, Call Sign, RST/No. Sent, RST/No. Received, Points Claimed. Contacts must be listed in numerical order.

In addition, there shall be a front sheet showing the following information:—

Name .... Address ....
Call Sign .... Section ....
Division .... (6-hour or 24-hour)
Points Claimed ....
Call Sign of other op./s (if any) ....
Location of Portable/Mobile Station ....
From .... hours to .... hours

A brief description of equipment used, and points claimed, followed by the declaration:

"I hereby certify that I have operated in accordance with the rules and spirit of the Contest."

Signed .... Date ....

10. The right is reserved to disqualify any entrant who, during the Contest, has not observed the Regulations and the Rules of this Contest, or who has consistently departed from the accepted code of operating ethics.

11. The decision of the Federal Contest Manager of the Wireless Institute of Australia is final and no disputes will be entered into.

12. Certificates will be awarded to the highest scorer of each section of each division. Additional certificates may be issued at the discretion of the F.C.C. The six-hour certificates cannot be won by a 24-hour entrant.

13. **Return of Logs:**

All entries must be postmarked not later than **28th February, 1970,** and be clearly marked "John Moyle Memorial National Field Day Contest, 1970," and addressed to:—

Federal Contest Manager, W.I.A.,
Box N1002, G.P.O.,
Perth, W.A., 6001.

RECEIVING SECTION

14. This section is open to all Short Wave Listeners in VK Call Areas. The Rules shall be the same as for the Transmitting Stations, but may omit the serial numbers received.

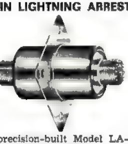
Logs must show the Call Sign of the Portable/Mobile Station heard, the serial number sent by it, and the Call Sign of the Station being worked

Scoring will be on the same basis as for Transmitting Stations. It will not be sufficient to log a station calling CQ. A portable/mobile station may be logged once only for phone and once only for c.w. in each band.

Awards: Certificates will be awarded for the Highest Scorer in each Call Area, for the 6-hour and the 24-hour divisions.

New Equipment

HY-GAIN LIGHTNING ARRESTOR

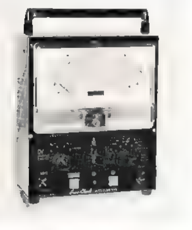


The precision-built Model LA-1 will safely by-pass to ground 10 or more direct lightning strokes. It is designed for installation in any standard 52 or 72 ohm co-axial feedline, and effectively removes static build-up around your antenna system, thus reducing the possibility of your equipment being hit by a direct stroke of lightning.

The unit will accept type SO-239 u.h.f. co-ax. connectors, the insertion loss is negligible, and weight is 5 oz. Price $29 including sales tax.

Further information from Bail Electronic Services, 60 Shannon St., Box Hill, Vic., 3129

SWE-CHECK FET METER



A new addition to the range of quality test equipment available from Radio Parts Pty. Ltd. is the Swe-Check "Volt-Ohm-A" FET Meter. Of robust, plastic coated, steel construction, the meter case has a 60° tilting device to enable easy readout when bench mounted.

Ranges—DC volts: 0-1, 3, 10, 30, 100, 300, 1K and 3K. AC volts: 0-3, 10, 30, 100, 300 and 1K. DC current: 0-300 uA., 1 mA., 10 mA., 100 mA. and 1 A. Ohms. R x 1 to R x 1 meg. in seven ranges Price $99 plus 15% sales tax where applicable

Further details from Radio Parts Pty. Ltd., 562 Spencer St., Melbourne, or city and suburban branches.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

RADIO OPERATOR OF THE ILL-FATED "NOONGAH"

Editor "A.R.," Dear Sir,

It may not be realised by some of your readers that S. B. Pedemont, VK2BSP, who appeared in Silent Keys last month, was the Radio Operator of the "Noongah" lost at sea in August

He was a "first tripper," and had just joined the ship in Port Kembla on what was to be her last voyage. Although suffering from severe sea-sickness, he cleared his distress traffic in a very efficient manner Everyone who heard the distress messages agreed that the general operating procedure and "fist" of Mr Pedemont was amazing, considering his lack of marine experience and the stresses he must have been under at the time

I feel that his Amateur Radio experience must have contributed to the cool manner in which he discharged his duties on this tragic occasion, and that he deserves salutations from his brother Amateurs for a job well done.

—Noel Roberts, VK2NR.

C.W. REQUIREMENTS

Editor "A.R.," Dear Sir.

I am prompted by VK2ZFQ's letter in October "A.R." to make some comments concerning the c w. requirement in the A.O.C.P. examination. I am convinced that the time has come to eliminate this archaic, unnecessary and unjust section of the examination. Further, I have very grave doubts as to the wisdom of introducing a Novice licence which included a c.w. requirement. My experience shows that the principal factor that is at present deterring a number of prospective Amateurs is, in fact, the c.w. examination. This fact is borne out by the great popularity of the Limited licence. Surely the main aim of the introduction of a Novice licence is to popularise Amateur Radio, and surely the saddling of the Novice licence with a c.w. examination would defeat this purpose.

The answer to the problem is, of course, to abolish the present c.w requirement in the A O.C.P. examination, without lowering the standard of the theory section. The standard of scientific education nowadays is so high that very few candidates have much trouble with the theory paper, but the c.w. test is a different kettle of fish!

However, I also base my opposition to the c.w. requirement on several other grounds, and these are as follows —

(1) There are many Amateurs (like myself) who have found that they have neither the time nor the aptitude to master the art of c.w Why should such Amateurs be denied the use of six of their bands simply because they are not proficient in c.w. And if c.w. is such a necessary thing, why is it not made compulsory for the v.h.f. bands as well as for h.f.?

(2) There are many Amateurs (including full A.O C.P holders), whose main interest lies in phone operation, and who would seldom (if ever) want to pound the brass. Why should these Amateurs be required to pass an examination in a mode they do not intend to use?

(3) VK2ZFQ says that c.w. is the most effective mode for weak signal DX work, and that phone has its limitations for DX of that sort. This is very true, I quite agree that c.w occupies a most important place in Amateur practice. However, I cannot agree that this is any justification at all for imposing a c.w examination on all Amateurs. Many Amateurs may not be interested in weak signal DX work, and there are many like myself who still prefer the more personal touch of the microphone, even for DX work.

(4) I feel that it is unfair to stratify Amateurs into different classes such as "Full", "Limited", and so on After all, we are all Amateurs, and all Amateurs should be permitted to operate on any and all Amateur bands, provided their technical knowledge and operating procedure are of a certain standard. The restrictions at present imposed on Limited licensees are contrary to their rights as licensed Amateurs.

Finally, let me reiterate that I am not opposed to c.w. as a mode, and neither am I opposed to the holding of c.w examinations. Certainly, no one should be permitted to transmit c.w unless they are capable of so doing, and an examination is the best way of making sure of this. However, why should a pass in the c.w. examination be a prerequisite for phone operation on the DX bands? Let's be fair about this: certainly there must be a c w. licence for those who want it, but why force it on those who don't? And why should those Amateurs who are not interested in c w be penalised by being deprived of the use of six of their bands?

I hope that these comments will arouse some discussion of the c.w. question amongst the readers of "A.R."

John Martin, VK3ZJC.

☆

AUSTRALIA TO CORNWALL, U.K., WITH ONE WATT S.S.B.

G6XN, on holidays in Australia and using the call VK7LM/P VK3 worked G3DDN and G3AYQ on 21/10/69, frequency 14155, using a one-watt s.s.b. rig. Reports from both Cornish stations to him were R5/S5. How's that for long path DX on QRP?

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Book Review

MODERN ELECTRONIC TROUBLESHOOTING

Using Up-to-Date Test Instruments and Advanced Servicing Techniques

Editors, Electronic Technician/Dealer

A new down-to-earth handbook that deals with today's electronic servicing problems on a practical level, using modern test instruments and advanced troub.eshooting procedures to cope with the special problems created by printed boards and solid state circuitry. It is hard to conceive of a book that encompasses monochrome and colour t.v., multiband radio receivers, hi-fi equipment, tape recorders, two-way communications equipment, and test instruments for servicing all this equipment. Yet this book does. How? By getting right to the subject of how to service the equipment without the usual wordy theoreticall discussions of how the circuits work.

This is a book for professional service technicians, dealing with the problems which are currently causing them the biggest headaches. The content is divided into five sections. The first four deal with troubleshooting techniques and test instruments for servicing solid state circuitry (in radio, t.v., hi-fi, and communications gear), colour t.v. circuits, hi-fi and stereo equipment and two-way communications transceivers. The final section is on test equipment —not the usual run-of-the-mill theory, but special information such as how to add a triggered sweep to your old scope, how to use an R/C bridge effectively, how to service your own test equipment, etc.

In all, the 24 chapters provide the kind of all-inclusive servicing guidebook service technicians have been asking for—one that defines the troubles most prevalent in today's electronic equipment, and concentrates on quick troubleshooting procedures for locating the causes.

256 pages, over 100 illustrations, five big sections, 24 chapters. Price: $US7.95 hardbound, $US4.95 paper.

WORKING WITH SEMICONDUCTORS

Al Saunders

A brand-new and practical guide to semiconductor circuit operation and application—of value to technicians and others who work with solid state equipment. The wonderful aspect of this book is that the reader—be he technician, hobbyist or engineer—can really develop a thorough understanding of semiconductors—and actually enjoy doing it! In striking contrast to the usual textbook approach, this brand-new volume avoids the dry, theoretical mathematical explanation—it simply tells how and why things work, backed up by large, clear illustrations. Under the expert guidance of veteran technician and instructor Al Saunders, many facets of semiconductors are exposed in a different light. With several all-transistor t.v's on the market, it is more urgent than ever that service technicians understand semiconductor circuits.

The author begins with a clear-cut explanation of simple junction diodes, N- and P-type semiconductors, and PNP and NPN transistors. The next chapter outlines simple but reliable tests and operating parameters. Chapter 3 describes basic circuit configurations and compares them to vacuum tube equivalents. The effects of temperature and biasing are treated in chapter 4, along with basic feedback techniques and curve tracing.

In chapter 5 the author begins to put things together, interstage coupling, impedance matching, temperature compensation, and continues in chapter 6 with actual practical circuits: Class A and B amplifiers, complementary PNP-NPN circuits, phase inverters, etc. Chapter 7 goes into r.f. and i.f. amplifiers, detectors, automatic volume control, and differential amplifiers. More advanced circuits are covered in chapter 8, preceded by an introduction to transistor oscillators, and then multivibrators, Eccles-Jordan and Schmitt trigger circuits, and crystal controlled generators, concluding with a thorough explanation of counting by "flip-flop" and binary arithmetic.

Succeeding chapters deal with power supplies, high-frequency circuits, field-effect transistors, unijunction transistors, tunnel diodes, SCRs, plus a dozen or so special purpose circuits designed for a variety of applications from audio amplifiers to zener diode functions (accompanied by component values for construction-minded readers).

224 pages, over 185 illustrations, 15 chapters. Price: $US7.95 hardbound, $US4.95 paperbound.

99 WAYS TO USE YOUR OSCILLOSCOPE

A. C. W. Saunders

Here is one of the most useful test equipment guidebooks to be published in recent years. Its pictured-text guide, with step-by-step instructions, encompassing just about every service application for the oscilloscope shows how to determine waveform frequency or amplitude, measure inductance and inductive reactance, check distortion and gain of transistor and integrated circuits, etc. Many applications deal with t.v. circuits, especially those used in colour receivers. More specialised uses include testing SCRs, tunnel diode oscillators and multivibrators, checking capacitors, aligning i.f. and chrominance circuits.

Written to give specific instructions for using the oscilloscope in servicing t.v. receivers and other home-entertainment equipment, numerous waveform photos are included to show ideal results, plus displays indicating circuit troubles and improper equipment set-up. In all complete information is included for performing 99 different analysis tests, encompassing just about every application the reader might encounter.

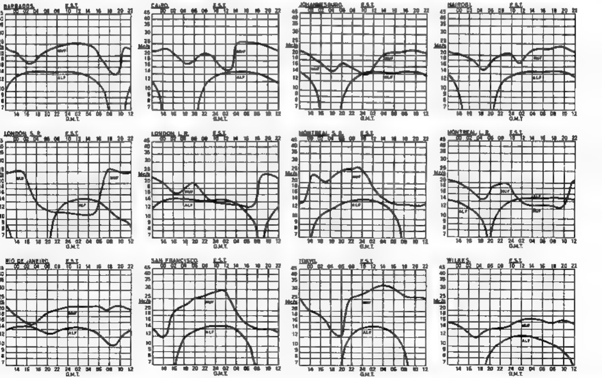
In each case, the text fully describes the procedure and a full-page pictorial diagram shows how to connect and adjust the equipment. Numerous waveforms photos are included to show ideal results.

Typical subjects covered include: Measuring inductance/reactance, power rectifier tests, transistor curve tracer, integrated circuit testing, stereo amplifier tests, testing audio by-pass capacitors, circular trace applications, matching capacitors, dual and triple trace tests, checking amplifier response, observing deflection waveforms, i.f. amplifier alignment, sound detector alignment (4.5 Mc.), 3.58 Mc. oscillator tests, checking colour-difference signals, keyed a.g.c. waveforms, synchroguide waveforms, flyback circuit waveforms, colour gating pulses, colour t.v. alignment notes, etc.

192 pages, over 100 illustrations, plus more than 200 waveform photos. Price $US8.95 hardbound, $US4.95 paperbound.

PREDICTION CHARTS FOR DECEMBER 1969

(Prediction Charts by courtesy of Ionospheric Prediction Service)



Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"BREAK-IN"

September 1969—

Stand-by Battery Float Charger, ZL1BHN. How to keep your car or field day batteries fully charged. Should appeal to some v.h.f. operators.

A 9 Mc. Bilateral I.F. Amplifier, ZL3AAY One section of a transistor transceiver

Linear Power Amplifiers, ZL2BFR. Handy theory session.

Generating R.T.T.Y. Tones, ZL2AVF For those interested in the mode.

Suppression of Transistor Power Supply Noise, ZL2BBO He says that the whine is not necessary

Diode R.F. and A.G.C. Circuit for Receivers, ZL4IO. Covers some interesting areas of receiver design.

Chatham Island DX-pedition, ZL1TU/C and ZL1IL/C. Part two of the story.

"CQ"

August 1969—

Putting the Central Electronics 100V and 200V on 160 Metres, KH6IJ This author suggests that some of the older secondhand units will make good 160 metre rigs.

Results of the 1968 "CQ" World Wide DX (CW) Contest, W1WY. All the details for those interested in DX.

Signals from Space, W3ASK. Satellite DX can be satisfying.

Slow Scan Television. Part two of an article begun in the July issue.

"CQ" Reviews the Swan 250C 6 Metre Transceiver, W2AEF This is a new model of Swan's six metre transceiver and mainly discusses the improvements.

The 3-DEC Unit, W2AEF. This is a system of bread-boarding equipment simply by pushing the wire ends of components into holes in a board. Up to date I have not seen it in Australia

Converting the Heath CB-1 to Six Metres, W6GNV/4. This article describes the conversion of a CB transceiver to six metre operation Also includes the addition of a simple audio squelch circuit.

The Inductotuner, W6SAI. The ingredients of a versatile antenna system to operate from 1.8 to 30 Mc., patterned after the AN/SRA25, makes use of a 35 ft. whip, a variable impedance matching transformer, loading coil and s.w.r. bridge. It will work into random lengths of wire.

Australis Oscar, W3ASK. Australis Oscar, the fifth in a series of satellites designed and built by Radio Amateurs is due to be launched soon. This article discusses how its signals can be received and tracked, how its telemetry signals can be used for scientific experiments, and QSL cards obtained for space listener reports.

September 1969—

Herbert Hoover, Jnr., W6ZH. 1903 to 1969.

The Evolution of a Circulator Coupled Paramp., W6NLZ. The circulator is the key to success with parametric amplifiers. Noise figure about 1 db.

Remote Antenna Tuning, WB2CQM. 1-2 r.p.m. motor and continuously variable capacitor produces do it yourself r.c.

Australis Oscar, W3ASK. The latest dope.

"CQ" W.W. DX Contest Records. For the DX man.

An Automatic Transistor Checker, W2EEY. Lamp type Go-No-Go indications.

Build a Complete Six Metre Station, WA2NDM. Part one, small mobile valve job.

Receiver Sensitivity and Noise Figure, by W2EEY. Do you confuse sensitivity and noise figure? If so, this is for you.

The Integrated Circuit Electronic Keyer, by GW3NJY

Modifying the Heath HP24 Power Supply for use with S.G. Tubes, W2EEY.

"CQ" Reviews the Heathkit SB-500 Two Metre Transverter, W2AEF.

"DAS DL QTC"

The journal of the German Amateur Radio Club, August 1969. This publication is of interest to those Amateurs who can read German or can get the articles translated. In the August issue is an article on an s.s.b. transmitter for the h.f. bands by Hans VK3AOU (ex DL1EZ). The German society is frequently in the forefront of developments and some of their articles look quite interesting.

In the August issue is one by DL9JH who describes how either a variable capacitor or a variable inductor (variometer) can be used to tune an L antenna to operate on either 80 or 40 metres. Perhaps some of the disposals equipment available out here would yield such components for use by VKs or perhaps a ferrite rod may give similar results.

Co-axial Fed L Antenna for 80 and 40 mx

This translation is pretty rough because it was done by someone who is non-technical and just dressed up a little by the writer

"Once the inverted L type antenna was very popular. A normal pi network made it easy. I had one which because it consisted of 41 metres of 3.5 mm. phosphor bronze wire, I considered it too good to throw away.

"Upon converting to s.s.b. I found myself faced with a pi network which would only match over the range 40 to 130 ohms and this did not match the 20 mx long open feeder of the inverted L. The question was, how to feed the antenna with 60 ohm (common impedance in Germany, designed to supersede both 50 and 75 ohms) co-axial cable and still work in 80 and 40 mx bands.

"The higher frequency bands were not considered, as experience had shown that a ground plane was superior to the L on the DX bands. The problem was solved elegantly by using odds and ends from the 'bag of tricks' The circuit can be arranged in either of two ways. A fixed inductor and variable capacitor or fixed capacitors and a variable inductor may be used. Using the fixed inductor-variable capacitor combination, I found that I could only obtain a low s.w.r. at one point in each band so I took a variometer of 8-36 microhenries from an old Army transmitter A capacitive divider was formed from values of 1 nF and 60 pF in series across the variometer and the 60 ohm cable fed to the junction of the capacitors with the larger value between the centre conductor and ground. The grid dipper showed that this combination covered the range 3.4-8 Mc. Because of the exceptionally high quality of the variometer the dynamic impedance of the circuit is about 40K ohms. Because the impedance of the L antenna was in the region of 3K ohms, it was easy to tap it onto a suitable point about one-third of twenty turns up from ground.

"The s.w.r. is now less than 1.1.05 in both the 80 and 40 metre bands and the harmonic suppression is of the order of 40 db.

"Experimenting showed this variometer to be useful up to input powers of about 150w. (r.f.) beyond which it needed special doping with a good insulator, such as UHU-pus, or arc-over was likely to occur For best results the variometer should be located at the end of the antenna with a very short feeder My variometer was tuned remotely by a small motor and the feed should be through a substantial insulator."

"HAM RADIO"

Although I have been a reader of American magazines for over thirty years, I did not really note the name Jim Fisk, W1DTY, until I was presented with a copy of a new Amateur magazine called "Ham Radio" at a convention in New York, during March 1965. Your Publications Committee has now obtained copies of this new publication for the current year.

"Ham Radio" is similar in page size to "QST", "CQ" and "73", pages are roughly half the size of our own "Amateur Radio" and measure 6½ x 9½ inches. Issues at present average 100 pages.

I have been surprised recently by some of the content of one of the American magazines which appears to be very "anti-A.R.R.L." I think this sort of attitude is very unfortunate in a magazine and I am happy to say that Jim Fisk's new publication does not seem to be "anti" anyone, he fills his issues with as much technical information as he can in well written and informative articles with quite a lot of meat in them. The magazine is well organised from cover to cover, layout is neat and the printing is beyond reproach. The cover price is 60c, whereas the cover prices of the others mentioned above is 75c, this probably means that you can buy "Ham Radio" for less than the others and if you are interested, I would suggest that you contact the subscriptions manager of the W.I.A. Our copies will be reviewed in sequence.

January 1969—

V.H.F./U.H.F Effects in Gridded Tubes, W6UOV. In all tubes the connecting leads have inductance and capacitance and at v.h.f./u.h.f. these sometimes cause problems.

Solid State Circuits for Single Sideband, F. H. Belt. Discusses a number of circuits which are used by the manufacturers of commercial equipment.

MOSFET Converter for 220 Mc., WB2EGZ. The author favours the R.C.A. types 3N159, 3N140 and 3N141 in the amplifier/mixer with 2N3478 and 2N3478 in the oscillator mixer chain.

Stub-Switched Stub-Matched Antennas, by W2EEY The author shows how transmission line sections can be used to match antennas at one frequency and switch at another Some practical systems are described.

Solid State Current Controlled Tuning, by K2ZSQ. Inductors which are varied by varying the current through a control coil. Very interesting technique; maybe the prices have fallen to "Amateur level" or they are available in disposals.

Some Notes on Cubical Quad Measurements, W4YM. Handy tips for those who may be contemplating the construction or adjustment of a quad.

Novel Linear for Two Metres, W4KAE. For those whose transmitters are of low output, a linear with an input power of 30 watts will

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give those extra miles. Uses inductive divider input and toroidal output circuits

"The Repair Bench." Larry Allen takes the beginner and any old-timer who feels he may learn something new, through trouble shooting routines on popular circuits.

Antenna and Rotator Preventive Maintenance, WA1ABP. Most of us fit 'em and forget 'em, perhaps working on the assumption that it is better to leave well alone. Ted Wooiner suggests that the beam owner can increase the life of his beloved signal squirter by some simple maintenance.

The DXer is catered for by such features as propagation predictions for the month. There is also a New Products section.

February 1969—

High Power Grounded Grid Linear, W6SAI. Two 3-500Zs in a high power linear

Signal Detection in the Presence of Noise, WB6IOM. Some methods of reading those signals you can hear but cannot resolve are given

Converting a Vacuum Tube Receiver to Solid State, W1OOP. Some of the older receivers, which are very good mechanically, can be converted to solid state to achieve more performance from less power. BC348—old chassis—new motor!

Power Supplies for S.S.B., F. H. Belt. The author discusses the required characteristics for the various modes of operation

Miniature Keying Paddle, K6RIL. VK1AU, in the October issue of "A.R.," said "if you cannot obtain or make a paddle, give it away!" This article is the answer to that problem.

Sloping Inverted Vee Dipole Antenna, W6NIF. A vee with a difference.

V.T.V.M. Modifications, W6HPH. Describes how to build in that ohmmeter supply, etc.

Analysing Incorrect D.C. Voltages, Larry Allen. Meter readings cannot always be taken for granted. This article tells why

Universal Transistor Preamplifier, W2EEY. John describes a pre-amp. to improve receiver S/N ratio from 80 to 6 metres.

March 1969—

Design Data for a High Power V.H.F. Linear, W6UOY. 2 kw g.g. linear for two metres. Maybe the "Moonbouncers" could get permission for one of these.

High-Stability Solid State V.F.O., W8YFB. If you already have a variable capacitor from a Command set this may interest you.

IC Frequency Calibrator, K5KA. Using a uL914, this calibrator uses an existing 100 Kc. crystal and voltage obtained from the filament line.

The Real Meaning of Noise Figure, K6MIO. Fully explained; if I stopped to read every word of every article I'd never get this column written, more's the pity.

Miniature Monitorscope, WA3FIY. A 902A and a handful of solid state components and you are on your way.

Novel Two Metre Ground Plane Antenna, W3WZA. Some Australian Amateurs have been using five-eighths on 144 Mc. This author makes a case for seven-tenths.

Safety in the Ham Shack. Jack Darr and Alan James take it upon themselves to show the uninitiated where they can go wrong before they wind up on the wrong end of a pair of conductors carrying high voltage.

Integrated Circuit VOX, W2EEY. Using uL914s, John says it is a big improvement on older circuits. No clacking relays either.

Propagation Predictions for March, WB6KAP. Continues his monthly feature.

Computers in Ham Radio, W5TOM. The author suggests that there is a need for such a device to take the drudgery out of it. I thought Amateur Radio was a hobby!

Repairing High Voltage Transformers. W6NIF suggests that the one you thought was a throw-away job may be capable of reclamation.

Ham Notebook. One of the features. This month D.C. Crystal Switching, S.B.E. Linear Amp. tips and Co-axial Cable Connectors, etc., in good measure.

"QST"

September 1969—

A Direct Conversion S.S.B. Receiver, W1DAX. A recent "QST" article has revived an interest in the direct conversion technique for radio reception. Simplicity with good performance are the advantages. This article describes an experimental receiver using a novel approach to the use of direct conversion for true single-sideband reception.

A Three Element Delta Loop Beam for Six Metres, W1ICP and K1QQX. Each side of the delta is about seven feet long and it seems that this type of antenna is a practical device for the 10 and 6 metre bands; it does not appear to be nearly so practical for 20 metres where the elements become rather unwieldy.

Squelch Circuits, WA5SKM. A review of principles and practical circuits.

Transistor Switching for the Micro-To, by W1JE. Modification to a popular c.w. keyer described in "QST" August 1967 and in the A.R.R.L. Handbook. Here the relay goes solid state

Grinding Technique for Surplus Crystals, W9PBI. Using the technique described here, the author has been able to make large changes in frequency without loss of activity.

Receiver Sensitivity. What it means. How it is measured. W7IV. Does a sensitivity figure of so many microvolts for such-and-such signal-to-noise ratio tell you anything?

Microcircuit Electronic Key, K2ERL. Combined keyer and audio monitor, all built on to a "bug" type base.

Strays. "QST" gives Cliff Tait, ZL1AKI, "the Flying Kiwi" a mention on p. 35. Cliff is touring the world in an Airtourer 115 (nee Victa) aircraft which was built in N.Z. He operates from the plane on 80 metres.

A Simple Two-Transistor A.F.S.K. Generator, WB2RHM. This a.f.s.k. generator for r.t.t.y. can be built for less than $10. Its low cost should not be used as a measure of its performance. The author's generator was given some gruelling tests in the A.R.R.L. lab. regarding output frequencies and it was found that after adjustment was made as described, it was necessary to use a frequency counter which would count in tenths of a cycle to measure the drift. Also handy as a test generator for your f.s.k. demodulator

An Inexpensive Ten-Minute Timer, W2HZZ. Another of those solid state devices built into a 3 x 4 x 5 inch mini-box. Designed essentially to warn the Amateur when to identify his station.

Modern Filter Design for the Radio Amateur, W3NQN. For the filter fiend.

Australis Oscar 5. Progress report. With pictures of Owen Mace, Richard Tonkin and Paul Dunn.

The Outstretched Hand, W1UED. Help in Amateur Radio for the handicapped.

"THE INDIAN RADIO AMATEUR"

August 1969. This is a magazine which will have been seen by only a few VKs and it is not my normal practice to review it because most of the technical content is reprinted from other journals.

The Indian kindred society obviously has many handicaps. Although India has a very large population, the Amateur is relatively rare and they have difficulty in obtaining parts for constructional projects as well as other difficulties such as the number of languages spoken in the country. By publishing articles taken from overseas magazines and contributed by the local loyalists, the Amateur Radio Society of India do a great deal to advance the cause of Amateur Radio in India.

"73"

August 1969—

This issue is stated to contain over 40 feature articles. These articles, covering a very wide spectrum, should interest everyone.

Listening in on Two Metre Repeater, K0VQY. A monitor receiver using only two transistors.

An FET Regenerative Receiver for 3.5 Mc. and up, W6OSA. Two FETs will allow you to have a ball on the lower bands.

Multi Channel F.M. Operation, WA7EVX. Adding relay crystal switching to commercial f.m. gear

The Case for the Five-Eighth Wavelength Vertical, W2EEY. This is the vertical with the low angle of radiation. Used for many years by thousands of broadcasting stations world wide.

The Genesis of Radio Reception, W1USM. A history lesson.

An Introduction to Integrated Circuits, by WA1FHJ. Let's hope that an intimate relationship results.

R.T.T.Y. Tone Generator, W7FLC. Now you can mark and space up a storm.

General Purpose Good-Bad Transistor Tester, W0KKA. Useless if all your transistors are in excellent shape.

A Compact Two-Metre Transmitter, W4UOY. 2E26 output, phone.

Measuring Ft of Surplus Transistors, by WA1FRJ. There are some enormous bargains around.

Skylines for 160 Made Simpler, W1EZT. 160 metre antennas from A to exhaustion.

The Triac, K8TSQ. New gadget you should know about. What next!

430–470 Kc. Sweep Frequency Generator, WA5SWD. That's Kc. not Mc. This is for aligning i.f. strips.

What Do You Think? K1OXK. A special "73" metaphysical feature.

Leaky Lines, K2AGZ. Grumbles by Sam, err, Dave.

Magikey—for Automatic Didahs, W3SGV. Another automatic key and a good one. Only two transistors

F.M.—Fun Maker, K2PTS. Are you missing out on the f.m. bandwagon?

The SB100 on Six Metres, WB4CXL. It's possible. (How many more will respond to similar treatment?)

Measuring the Frequency of Unmarked Crystals, K1EUJ. Different, simple ways of doing this.

Extra Class Study Course, Part VII., by the Staff. There is no excuse for failing the test if you read this.

Now You Too Can Have A Deviation Meter, K8STM. Don't deviate too much.

Two Transistor 1500-mile Transmitter, K0VQY. Quarter watt QRP rig for excitement.

Long Circular Quads, WA4KAE. For moonbounce work.

Measuring F.M. Receiver Noise Figure, by W3BBB. Taking the mystery out of this for f.m. receivers.

Would You like to be a Broadcast Engineer? K2ULR. No!

Distress: The Amateur and the Coastguard, WB6UKX. What happens when an Amateur passes along a distress call.

A Transistor Parameter Tracer, K3PUR. Useful, unless tubes come back again.

What Are We Here For? W8RHR. Sometimes, as we tune the bands, perhaps we wonder too.

Plus a number of other features. Comments are mostly from "73" which has a prepared review on page 1.

September 1969—

A DX Curtain for Fifteen Metres, VE1TG. Many Amateurs have heard of the "Sterba Curtain," not too many will own one. Gain 3-4 db. over a dipole

Tunnel Diodes—Theory and Practical Applications, K8TSQ. Including a one transistor, solar powered transmitter.

The Magic Tee, by Thorpe. Methods of running r.f. transistors in parallel.

Uncle Will and News from Poudre Valley, K0VDI. In dialect yet.

Basic Soldering Outfit, W1EXT. Good Lord, another article on soldering.

Light Naturally Runs Down, K1CLI. A special scientific American type feature.

Cable Pick-up and Shielding, W2EEY/1. Keeping interference to a minimum

WWV—Pioneer in Standards Broadcasting, WA1AAU. Perhaps you've heard the catchy tune they play

Basic Theory and Applications of Transistors, WA1FHJ. Something you have always wanted to know

Series Gate, Solid State, K5ZFV. Clipper.

Improving NC300 S.S.B. Reception, W1OOP. It was good, now it's better.

A.F.S.K. Generator, W1ESH. Crystal controlled, using digital ICs.

Transistor Transmitter Aspirin, K0VQY. How to keep from Westernising your transistors. (Dead one's tell no tales.—Ed.)

Improvement of Phone Intelligibility by Base Clipping, by Ives. Discussion of base clipping.

Measurement of Meter Resistance, WA6NIL. Making it possible to versatilise your meters.

Diode Stack Power Supplies—The Easy Way, K5KA. Instant operation of the Henry 2K and other rigs.

Transistor Testing Techniques, W9KXJ. Testing with a v.o.m. without destruction.

2½W. Transmitter, K0VQY. Work the world with this three-transistor rig.

Neutralising the HX10, W2PQG. Simple way to stabilise this rig

More Taylor Modulation, DL5KS. Remember that a.m. is still on v.h.f.

An Audio Sinusoid Generator, W8FOO. Two ICs.

Capacitor Usage and Electron Flow, W0HMK. Where to use what capacitor and why?

What About FM? W9VZR. We'll have you on f.m. this year

A Primer on Radio Propagation, WA1GEK. If signals really do bounce, this is how it works.

Measurement of Percentage of Modulation, by Granger. Of a.m. transmitter

Extra Class Licence Course, Part VIII, Staff. Let's get cracking.

Big Signal—Good Looks, WA7AIA. 3-400Z k.w. linear

A New Vidicon Camera for A.T.V., W8VCO. Isn't it time you tried a.t.v.?

Two More Transistor Testers, W8DJZ. Handy if you use bagsful

The FET Compressor, WA0IOC. Audio compressor using two FETs.

DX

Sub-Editor DON GRANTLEY
P.O Box 222, Penrith, N.S.W., 2750

(All times in GMT)

The month of October has been a good one from a DX point of view, with some good openings occurring for the VK/ZL DX Contest. This event provided some very good openings on all bands, however a little more activity from VK and ZL would have helped. I spent about half the allotted time each week-end and was very surprised to note the conditions on 15 metres, also 10, in fact I hardly shifted from 15 over the c.w. week-end.

These good conditions are prevailing at the present time, and Mac Hilliard reports that 10 metres has been wide open to Europe on occasions at 1000z, with early morning conditions on 20 being comparable to those of the 1957 era. Sunspot count for June showed an average of 102, with wide variations from a daily low of 26, to a high of 186. Forecasts for November and December is 91 and 89 respectively

George Studd, ZL2AFZ, comments that the use of the ZM prefix has given Amateur Radio in that country a much needed boost, he himself filled a log book in six days, working all continents in one hour. Similar conditions should prevail when we use the AX prefix next year

Recently under the Awards heading I ran a short note on the Lincoln Award and the query has been raised as to whether or not Port Lincoln in S.A. would be eligible. Stew Foster assures me that it is, and counts for 20 points

The following are active from the Svalbard Archipelago, JW8MI, JW6QL, JW7UH, JW2QK and JW8DL. The first three are there for almost a year, JW8MI being active on 14060 c.w and 14190/195 s.s.b.

Stations active from Thailand at time of writing are HS1AF, HS2JR, HS3EP, HS3LJ and HS3ML, all are putting out good signals on 15 metres s.s.b. at around 1800z.

UA0NM continues to be active on Fridays from 1900 to 2100 on 14175 s.s.b. He is in Asiatic Russia, from Zone 19. Also from the same area is UA0IJ who is usually on 14025 on c.w

CE9AT is heard regularly working CE3ZN on 14185 s.s.b. Fridays at 2115z. QTH is South Shetland Is.

Here are some more "nets". **The Pacific Inter-Island** net meets Mon., Wed. and Fri. at 0830 on 14320 with a KX6 as M.C. **The South East Asia** net meets daily at 1300 on 14320. **World DX Round Table** operates 14370 s.s.b. Wed. and Sat. at 0500 to 0600z with WA5UHR in the chair

The VU0 prefix in use by Indian Amateurs for the month of October was in Commemoration of the late Mahatma Ghandi. QSLs for these stations to be sent to Box 6588, Bombay.

IT0ETN is good only for the prefix hunters, frequencies are 14196 and 21345 s.s.b. QSL to Box 366, Catalina, Sicily

MID is active daily 14100, 14150, 14180 s.s.b., and some 21 Mc. operation No times are given, and Giovanni can speak French but very little English. However, if you do hook him and want a QSL, send to I1MKN with I.R.C

The OG prefixes heard recently were special calls issued for the SAC contest by the OH authorities, they count for the prefix hunters only

FR7ZP/E which has been active for the past month is at Europa Op. is Maxime who will go QRT at the end of October All QSLs to Box 4, St. Clotilde Reunion Is., Indian Ocean.

KH6NR/Kure from Nov. 10 to Nov. 14, requests that all QSLs be sent to KH6NR, Kure DX pedition, 530 Peltier Drive, Honolulu. Hawaii, 96818, U.S.A.

5B4ES, another for the prefix hunters, is active 21220, 28675 and 14250 from the English School Amateur Radio Club, Nicosia, Cyprus. His QSLs go to the International Short Wave League which is now located at 1 Grove Rd., Lynley Glos. England, GL15-5JE

Did you work LT0ETN during the period Sept. 26 to 28? Then you are eligible for the ETNA award and medal, for which you apply to Sezione ARI Box 366, 95100, Catania, Sicily, with 15 IRC's. Also awarded for working any two other stations.

4J9DX is another for the prefix hunters. He was UA9AN and operators from UA9KAI and UA9KAX operating from the South Ural Mountains during the "CQ" Contest

Prefix hunters are really being catered for, here are a couple more PZ0AA from Surinan Trade Fair recently, QSL to Box 566, Paramaribo, Surinan. WC4GSC from Ogeechee Exhibition, Statesbro Georgia. QSL to W4DQD. Also EI0RTS from RDS scientific exhibition in Dublin on Oct. 21 to 25.

YB1BC still very much active and putting a massive signal into VK3. Barry VK5BS has apparently worked him and states that his QSL return is very prompt if sent to Box 288, Bandung, Indonesia.

There has been little or no operation from Qatar lately, but OD5BZ has plans to go there late Nov. or early Dec.

ZD3JJ is active from South West Africa on 28610, and requests that QSLs be sent to him at Box 5639, Windhoek, U.S.A.

From the Long Is. DX Assn. bulletin comes an item which will be of interest mainly to S.w.l's. It concerns BY1C and BY1F, both are active, and both say QSL via Radio Peking. It states that after sending your QSL to Radio Peking, you will receive newspaper monthly. You certainly will, and I suggest that you ignore them and don't give them the opportunity to use Amateur Radio as a propaganda outlet.

Still a few more nets. The YL-SSB net covering Oceania meets 14333 on Sat. from 0300z. Marine Corps net 21300 daily from 1900. Marianas net 14240 Tues. and Thurs. 0830. CHC/FHC net on 14340 daily from 1800, and on 7070 Sun. 1000z. Royal Navy ARS 3720 on Wed. from 1800. Finally, the British Commonwealth net meets daily on 21354 or 14285 from 1430 with 9V1PA as net control, and usually consists of service personnel.

LA2PH/MM is often heard coming in 5 by 9 into VK2, QSL address for him is to his home address, Knut Gjertsen, Lailavold 2, Lofterod, Sandefjord, Norway.

I mentioned at the start of these notes that there has been much increased activity on 10 metres. Some of the calls logged, heard, or worked in VK and ZL over the past few weeks are DU1FH, UG6GM, UL7OA, VS9MB, VU2DK, 5N2AAF, 9Q5DG, EA8DV, HV3SJ, KG6AQY, KP4DCR KV4FZ, LA0AD, MP4BHR, MP4TDA, TR8DG, UD6APO, VK9BB VP8HZ, YN2JS, 8P6AH, XW8CS, UA2SU, 4S7WA, 9M2DQ.

To go lower in the spectrum, down on 80 metres there has been quite an upsurge in activity. In the interests of space, I will quote some of the prefixes which have been either logged or worked on both modes in VK and ZL over the past month. TI2, DJ6, DJ7, I1, HB9, PA0, ON4, DK3 DL5, CP1, CT2, FG7, VO1 4U1, 4X4, OA4, OD5, 5Z4, OH0, 9G1, 9M2, TF5, 9Y4, JA WA6, W1, W2, F3, F2, W9, GI3, LU2, G8, OH1, OH3, G2, F9, LU4, VE7 and many other W call areas.

Despite the good conditions, there is not a great amount of DX news this month. However, I would once again remind those interested, that the Pacific DX net broadcast a very fine bulletin of DX news at the start of their Friday evening session at 0530z on 14270. Look for net control KH6GLU

Some time ago I mentioned the use of the Z following the numeral in certain DU calls. Here is a list of stations together with their QSL managers. DU1ZAA/K2IRT, DU1ZAB/W7UXP, DU1ZAC/K3MOV, DU1ZAE/W4JNR, DU1ZAF/9G1TV, DU1ZAG/WB6GFJ, DU1ZAH/W4SUS, DU1ZAI/KG6APJ, DU1ZAJ/W7UUO, DU1ZAN/W1GL, DU1ZAW/W3EIV, DU8ZAD/W3MOV

QTH SECTION

(By courtesy of the ISWL)

A2CAU—J. Large, Box 200, Francistown, Botswana, Africa.
CP1GN U.S. Embassy, La Paz, Bolivia.
C2IJW—R. J Wirth, C/o. OTC, Nauru Is., Central Pacific.
CE0AE—Op John, Det 517, APO, New York, N.Y. 09677, U.S.A.
DK1YK—E. Stammerberger, 5 Sauerbruchstr, 8630 Coburg, West Germany.
F5PE—E. Ermiz, Ferme Boulouch, 32 Lectoure, France
FM7WO—B.P. 287, Fort de France, Martinique, French W.I.
FG7XL—B.O. 100, Pointe-a-Pitre, Guadeloupe, F.W.I
HB0AFM—Box 293, 8040 Zurich, Switzerland.
JT1AK—Box 639, Ulan Bator, Mongolia, Asia.
KC5AT—Box 94, Ponape, East Caroline Is., 96941, Pacific
KC6ES—E Sugiyama, Koror, Palau Is., West Carolines, 96940
LA5KG—Postfack 150, Slependen, Norway.
LU4VL—Apto 121, Allen, Rio Negro, Argentina.
MP4BHH Box 155, Manama, Bahrian, Arabian Gulf.
MP4BHL—Box 144, Bahrian.
OH2AM Box 40015, Helsinki 40, Finland.
PJ9BG—C/o. Trans World Radio, Bonaire, Netherlands Ant.
PJ9VL—Box 692, Curacao, Netherlands Ant.
PY4AP—CP 484, Belo Horizonte, Minas Gerais, Brazil
TR8DC—Guy Delas, Box 356, Libreville, Gabon Rep.
VE2AFC—BP 382, Quebec 4, PQ, Canada.
VS6AA—C/o. HKARTS, Box 541, Hong Kong.
VR2FT—L. Higginbotham, Box 3722, Samabula, Fiji.
W3AWU/YB6—3030 Marshall Rd., Pittsburg, Penn 15214, U.S.A
YJ8BM—J MacIntyre, Dept. of Telecom, Santo, New Hebrides.
YJ8RG—R. Graham, C/o. P.O. Vila, New Hebrides.
ZE1CY—Bob Furzer, Box 738, Gwelo, Rhodesia
ZS6LW—Box 638, Germiston, Rep. of South Africa.
5Z4LS—Nick Henwood, Box 448, Nyeri, Kenya.
5V4DB—BP 123, Lome, Togo Republic, Africa.

The prefixes C3A-C3Z have been allocated by the I.T.U. to the Principality of Andorra Formerly PX1, that prefix was unofficial and in reality belonged to Brazil

Unfortunately, I will have to close these notes here this month. However, I will have a full screed for the next issue. My thanks this month to George ZL2AFZ, Mac Hilliard, Maurie Cox, Geoff Watts DX News Sheet, LIDXA, Barry VK5BS, ISWL, Jack VK3AXQ, Ernie Luff, Bernard Hughes and Stewart Foster of England. Until the next time, 73, Don L3022.

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VHF

Sub-Editor ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233

I take on the preparation of notes for this page still with a degree of hesitancy, wondering if I can do what is expected of me. There is no doubt that the degree of v.h.f. operation on all bands has declined during the past three or four years. I believe there are two very important reasons for this. Firstly, the operation of Channel 0 has had a widespread effect. Not only has it made it more difficult for operators within the service area of these stations to be active, but in removing their operation from the 52 Mc. band there are, as a consequence, less stations for others to work during a DX opening, and in periods of non-DX many will not risk coming on the air anyway, although it does appear some station operators have been able to overcome their problems to a certain degree.

The second very important reason is the reduction to 10 w.p.m. in the c.w. requirements to achieve a full call. Many prominent v.h.f. men of a few years ago now have a full call sign, and therefore share their operating time between v.h.f. and h.f. Previously with no other bands to use, they would stay around and look for and work the DX, particularly on 2 metres, as it appeared, often spending hours doing it. Now, if a few calls on v.h.f. fails to provide a wanted QSO, it is so easy to fire up on h.f. and work someone. These two factors added together have made it very difficult for the keen v.h.f. operator to remain as enthusiastic as previously, with the result he goes and builds some fresh equipment, perhaps for a u.h.f. band which are largely for local operation anyway.

The purpose of this page in the future will be to try and foster more interest in v.h.f./u.h.f., particularly with a view to promoting contacts with neighbouring and other States. I am a keen advocate of portable operation, and if our measure of activity in this direction were to match that keenness which exists in ZL, I would be satisfied. Today with the advent of transistors, and the greater knowledge of their use, particularly by the younger members of our fraternity who have grown up with semiconductors around them, portable equipment need not be either expensive or elaborate. Providing a few basic rules are kept in mind, the results can be very happy.

High power is not necessary, 15 watts on 144 Mc. from a QQE03/12, coupled to a 10 element yagi from any reasonable sized hill, plenty of modulation (though you will need a high level clipper and filter if you are going to thrash this), a good transistor or FET converter feeding into a car radio or other reasonably good receiver, will give you contacts from 200 or 400 miles without a lot of trouble, and in excess of 400 miles when conditions are good. Early morning is often the best time, but many long hauls have been made during evening hours as well. And when there is a field day or contest, there is a great thrill in working some 20 or 30 different stations on 2 metres in a couple of hours or so. As this is one of my chief platforms here in VK5, I will be pleased to answer any queries on portable operation from anyone interested.

BEACONS

The advantages to be gained from these are so great it is hard to understand why they are not operating in all States on 52, 144 and 432 Mc. We can pardon VK3 and VK4 on 52 Mc. as their Channel 0 t.v. is generally a reasonable guide as to band conditions. Many openings to VK2 must be missed however because of lack of indication from there.

I note the long awaited 144 Mc. beacon in VK3 will soon be a reality, but we could certainly do with one on that band in VK4 and VK2, and you chaps in N.S.W. cannot really shelter behind Channel 5A on 143.750 at Wollongong. It might help the ZLs, but in the direction of the Western States it could well be too far removed from the centre of 144 activity to be much use on most occasions.

VK5 is experimenting with a 432 Mc. beacon and VK6 has one which can be turned on by request.

The following is a list of beacons and pseudo-beacons, and it is hoped the Editor will grant space for this list regularly: one never knows into whose hands a copy of "A.R." may fall, and they may be unaware of the operating beacons if not published regularly.

VK2	51.740 Mc.	Western N.S.W.
	143.750 Mc.	Channel 5A Wollongong.
VK3	51.780 Mc.	Channel 0 Melbourne.
	144.700 Mc.	Under construction.
VK4	51.750 Mc.	Channel 0 Brisbane.
VK5	53.000 Mc.	VK5VF, Mount Lofty.
	144.800 Mc.	VK5VF, Mount Lofty.
VK6	52.006 Mc.	VK6VF, Tuart Hill.
	144.500 Mc.	Mt. Barker, near Albany.
	145.000 Mc.	VK6VF, Tuart Hill.
	435.000 Mc.	VK6VF (on by request)
VK7	144.900 Mc.	VK7VF, Devonport.

CONTESTS

Two contests of note for v.h.f. operators are the Ross Hull Memorial V.h.f./U.h.f. Contest commencing 6/12/69 and the John Moyle Memorial National Field Day commencing Saturday 7/2/70. The first is a very worthwhile contributor to band occupancy during the summer DX season, and some excellent scores have been attained over the years. There has been a suggestion made that the contest should be abandoned because of the small number entering logs. It would be a pity for this to happen, so I can only appeal for a greater log entry. Perhaps there is a way of overcoming the rather tedious job of writing up the Contest Log to obtain scores and to assure the Contest Committee of your honesty. Any suggestions?

The John Moyle Field Day provides an excellent opportunity to go out portable, and being in the warmer part of the year is generally ideal for camping out overnight. It is hoped the 1970 Field Day will see a greater participation by VK5 v.h.f. stations seeking to work interstate, rumours of equipment being constructed tends to confirm this.

The VK2 Division V.h.f. and T.v. Group are lending support for the 1970 John Moyle Field Day by holding their summer V.h.f./U.h.f. Field Day over the same week-end instead of the New Year period. It appears in the past some operators have gone out mountain-topping for one or the other event, not both, so it now appears there will be a rush to get to the favourite mountain site. The rules are at present in the drafting stage, and will be mailed to those interested, all Divisional V.h.f. Groups, Divisional Stations, etc., as well as the VK2 "Bulletin".

In abridged form, the rules allow one contact every clock hour on each band 52 Mc. upwards, with an "incentive factor" increasing as the band frequency goes higher. The system also favours portable/mobile operation. The VK2 event commences 1400 EST on Saturday, 7th Feb., until 2200 EST, then re-commences the next day at 0400 continuing to 1600 EST. 18 of the 30 hours of operation are common with the N.F.D. Scoring for a given QSO is the product of the distance factor and the multiplier. The distance factor is 1 for every 10 miles, and the multiplier is the sum of the transmitting incentive factors of the two stations in contact. (Out with the slide rules chaps!)

The VK2 V.h.f. and T.v. Group are really keen. They are considering a special 24-hour "AX" V.h.f./U.h.f. Contest from midnight on 31/12/69 to midnight 1/1/70 to launch with a big splash the new Cook Bi-Centenary Year "AX" prefix. All bands 52 Mc. and up, all modes, nets, etc. Certificates for highest scorers on each band and so on. How about the other States doing something along similar lines? Summer DX will be with us and 52 Mc. contacts across the continent may well be possible. Too late for much to be said in "A.R." before the event, but State V.h.f. Groups could take up the matter locally. Go to it.

The 8th Annual Convention of the VK3 V.h.f. Group was held at Moondarra Reservoir in the Gippsland area on 11th and 12th October. About 60 Amateurs plus various families attended. Events included sniffer hunt, disposals sale, films on the Saturday. To the dismay of the scrub-battered sniffer contestants the event was re-run on the Sunday! Sunday's events included scrambles, mobile efficiency competition and a fox hunt. In this last event two transmitters were used, separated in frequency by 1 Kc. and positioned either side of a road cutting. The winner of the event, Kevin VK3ZYP, covered the 2-mile distance in 2 hours, while Dale VK5ZER took 60 miles to get there! The seven main events had a formidable prize list, which included such items as QQE06/40 base station, 1049 units, 6 mx mobile, QQE03/20, microphones, crystals. Unfortunately, the list supplied to me is too long for inclusion in "A.R." but prizes of this nature were given to the first three placings and sometimes the fourth, so you can gather that someone had been very busy twisting the arms of various distributors, who in turn were very generous indeed.

The VK3s enjoyed an end of October temperature inversion with DX stations up to 300 miles away very strong. Quite a few VK7s were worked, and VK7VF, the 144 Mc. beacon, gave the usual warning of the opening. The beacon was also heard in Mt. Gambier at about S7 for 30 hours. Some of the longest distance contacts were between Allan VK2ZEO in Deniliquin and Wilf VK7WF on 144 Mc., and Colin VK5ZKR in Mt. Gambier working Wilf on 432 Mc. No news of 1296 Mc. activity in VK3 this month. Would appreciate some information please.

In VK5 main interest has centred on the V.h.f. Field Day at the end of September. There was quite a good roll up of VK5 stations who were indeed grateful to the many VK3s in the Western Zone of Victoria for giving them QSOs. Band conditions were best the night before the Field Day started, but even on the declining conditions of the Sunday, 144 Mc. contacts were easy up to 300 miles, and 52 Mc. contacts good copy at 250 miles. Bob VK5ZDX burnt much midnight oil during the weeks previous to the Field Day while building a complete v.f.o. controlled 100w. 6 and 2 mx station, with all facilities. Joining up with Wally VK5ZWW, these two had a real "field day" and scored in excess of 11,000 points to win the Field Day. John VK5QZ and I teamed up and ran into second place with 7,574 points, also with specially built portable equipment. The Port Pirie Amateur Radio Club under the sign of VK5PP went into the field with a team of young operators to gain some experience. With my keenness for field days, I was very pleased to see the considerable number of operators who did actually go out portable.

Doug VK8KK is on his way to Adelaide from Darwin via the Eastern States on an extended leave holiday, arriving around 7th December. Just to keep his hand in at DX, Doug worked an HL9 on 52 Mc. prior to leaving Darwin. This indicates the 3 element Yagi he uses is working!

Much interest centres around the VK5QZ 432 Mc. converter which has been made a project by the VK5 V.h.f. Group. Initially 50 kitsets will be available at a most reasonable price, and the experimental beacon made by John VK5QZ will be a useful piece of apparatus when it comes to alignment and on-air tests. The appeal this converter has is its simplicity and that it is capable of very good results.

1296 Mc. RECORD

A South Australian record for a two-way contact on 1296 Mc. was set on the morning of 28th September about 0745 when Rod VK5ZSD at home at Eden Hills near Adelaide, contacted Alan VK3ZHU/5 located on South Hummocks. The distance was 75 miles, signals 5 x 9. Rod was running 25 watts to 3CX100A5 tripler, driven from 432 Mc. using a QQE06/40. Antenna 8 over 8 slot 25 feet high, receiver consisting of three cavity front end to a 1N21E diode mixer. Alan ran 20 watts to a 2C39 tripler from 432. A five-foot parabolic dish, focal length 27 inches slot fed reflector dipole, 6 feet high on the top of his car was the antenna. Alan's receiving set up was similar to that of Rod's. Congratulations gentlemen, now you will be after the Australian record. However, by the time you read this, Rod will be a resident of VK2, complete with his multitude of equipment, so further 1296 Mc. activity may be stimulated in that State.

MEET THE OTHER MAN

Mick VK5ZDR lives at Henley Beach, 7 miles west of Adelaide, at an elevation near enough to sea level. He is one who has done much to pioneer long distance contacts on 144 Mc., and was probably the first to realise the potential of using weather patterns to assist his DX operations, enabling him to call at the right time in the right direction. Mick has worked VK2, 3, 4, 5, 6 and 7 on 144 Mc., a most creditable performance, while on 432 Mc. holds the Australian record of 405 miles to Ian VK3ALZ in Melbourne, set on 28/5/66. His list of call areas worked on 52 Mc. is very impressive as it includes all VK areas 1 to 9 inclusive, ZL1, 2, 3 and 4, and all districts of Japan.

First licensed in 1959, Mick was not long in making his call sign known throughout Australia by winning the Ross Hull Contest in 1961/62, second in 1962/63 and again first in 1963/64. He also served a year as chairman of the VK5 V.h.f. Group, and is a regular member of the W.I.A.

Here are some brief details of the equipment used by Mick. 52 Mc.: 100w. input to 829B, 6 element yagi 45 feet high, converter uses 6AM6 r.f. stage. 144 Mc.: 90w. input to QQE06/40, 10 element yagi 55 feet high, 7077 grounded grid r.f. amp. in converter. 432 Mc.: 80w. input to QQE06/40 to either 32 element

(Continued on Page 32)

INTRUDER WATCH NOTES

A. W. Chandler, VK3LC, has replaced M. P. Davis, VK3ANG, as Victorian State Intruder Watch Co-ordinator.

STATE INTRUDER WATCH CO-ORDINATORS

VK2—W. H. R. Treloar, VK2BPZ, 23/8 Fullerton St., Woollahra, N.S.W., 2025.
VK3—A. W. Chandler, VK3LC, 1534 High St., Glen Iris, Vic., 3146.
VK4—C. E. C. Kenny, 19 Lithgow St., Wynnum North, Qld., 4178.
VK5—John Bulling, VK5KX, 297 Goodwood St., Kings Park, South Aust., 5034.
VK6—G. Allen, 283 Amelia St., Balga, West. Aust., 6061.
VK7—D. H. Kelly, VK7DK, 56 Upper Brougham St., Launceston, Tas., 7250.

PROVISIONAL SUNSPOT NUMBERS

OCTOBER, [illegible]

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	[illegible]	16	[illegible]
2	101	17	36
3	96	18	43
4	92	19	35
5	103	20	87
6	117	21	102
7	120	22	107
8	92	23	134
9	89	24	133
10	78	25	157
11	63	26	142
12	60	27	139
13	47	28	121
14	55	29	113
15	46	30	95
		31	80

Mean equals 89.9.

Smoothed Mean for April 1969: 103.0.

—Swiss Federal Observatory, Zurich.

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VHF NOTES

(Continued from Page 31)

extended phased array or 13 element yagi 50 ft. high, E88CC cascode front end in converter. The tunable i.f. range of 27 to 29.5 Mc. is utilised in his Yaesu Musen FR100B receiver which is used for all three bands. The modulator has Class B zero bias 807s with high level clipping and filtering. This latter Mick considers essential, both for oneself and others. Not long ago he spent 12 months at Tantanoola in the South East of S.A. and was keen enough to lug all his equipment down there with excellent results.

Plans for the future include working VK6 on 144 Mc., forward scatter experiments on 52 Mc., and possible operation on 576 or 1296 Mc. If the past is any guide, it is certain Mick will achieve all these things, and Amateur Radio will be the richer for it.

NEW ZEALAND

Our friends across the Tasman in New Zealand are holding their V.h.f. Field Day on Saturday and Sunday, 6th and 7th December. Amateurs in VK could well keep an ear on the bands for inter-country contacts. ZL1BFA and ZL1AJP have had another two-way contact on 3300 Mc., this time over a distance of 86.25 miles, contact was loud and clear using f.m. Further experiments are being undertaken to extend this distance.

John ZL1AZR continues his Moonbounce skeds with Kjell SM7BAE and Dick K0MQS. In a recent letter he says that he is replacing his present Earth-Moon-Earth aerial (eight 5/8 skeleton slots) with eight long yagis which feature high feed impedance driven elements. The new aerial will have about 22-23 db. gain compared with the 20 db. given by the slot array. John says that it is most necessary to use high impedance dipoles in stacked yagi arrays for it is almost impossible to drive low impedance units in large arrays.

The ZL3 144 Mc. beacon has received Post Office approval, and with every hope of being operational by the time these notes are read. No details of frequency as yet, perhaps by next issue.

This being my first issue of notes, and having very little idea what space a typewriter takes compared with the printed word, will wait and see if I have been too eloquent or not. I acknowledge with thanks information supplied by Peter VK3ZPC, Peter VK3ZYO, Mick VK5ZDR, "Break-In" and "Spectrum", the latter two being New Zealand publications.

For future pages I am looking for information of national interest, something which can be read and appreciated in all States. Anyone may contribute, but all information will be re-edited, and acknowledgments given near the end of the v.h.f. page. Plenty of notice regarding contests, field days and other events will ensure some publicity will be given prior to the date of the event. Lengthy writing about any particular subject must of necessity risk fairly severe re-editing to keep it interesting to all, and save space.

I look forward to a happy period with you all. Traditionally, I always close my notes, wherever they are printed, with a thought for the month: "In a democracy, the votes of the vicious and stupid count. But under any other system they might be running the show." A Merry Christmas to all. 73, Eric VK5LP ("The Voice in the Hills").

W.I.A. V.H.F.C.C.

New Members

Cert. No.	Call	Confirmations 52 Mc.	144 Mc.
60	VK3ZOO	—	100
61	VK1VP	—	100
62	VK3ZOP	100	—
63	VK4ZKC	170	—
64	VK3ZKP	—	100
65	VK3ZRB	—	109
66	VK3RV	—	103
67	VK5ZKW	161	—

FEDERAL AWARDS

AUSTRALIAN D.X.C.C. COUNTRIES LIST AMENDMENT

Deletion: EA9 Ifni. Only contacts made prior to 13/5/69 will be credited. Contacts with stations located in the former Spanish territory of Ifni made after that date will be counted towards the Morocco listing.

All D.X.C.C. members who have claimed Ifni have had their scores amended as necessary.

—Geoff Wilson, VK3AMK,
Federal Awards Manager.

CONTEST CALENDAR

6th Dec. '69 to 11th Jan. '70: Ross A. Hull V.h.f. Memorial Contest.
6th/7th Dec.: CHC International DX Contest (c.w.).
13th/14th Dec.: CHC International WX Contest (s.s.b.).
7th/8th Feb.: John Moyle National Field Day Contest.
7th/8th Feb.: 36th A.R.R.L. International DX Competition (1st phone week-end).
21st/22nd Feb.: 36th A.R.R.L. International DX Competition (1st c.w. week-end).
7th/8th March: 36th A.R.R.L. International DX Competition (2nd phone week-end).
21st/22nd March: 36th A.R.R.L. International DX Competition (2nd c.w. week-end).

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DECEASED Amateur's Equipment: 1 Yaesu Musen FR50 Receiver, 1 Yaesu Musen FL50 Transmitter, 1 Yaesu Musen FV50 Transistorised V.F.O., 1 home constructed aerial tuning unit plus an indicator with 0-100 microammeter, 1 Aiwa Crystal push-to-talk Mike. This comprises a complete station having either independent or transceive operation plus the outboard V.F.O. for separate transmitting. The transmitter has VXO for plug-in crystals with between 6 to 7 Kc. shiftability. Firm offers please by mail, preference to a purchaser taking all. All offers will be replied to, your phone number an advantage. Write to Bob Thompson, 91 Lucan Ave., Aspley, Qld., 4034.

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FOR SALE: Geloso G222 Transmitter and G209 Receiver, Panda 10/15/20 mx Beam complete with prop. motor with transformer rotator in covered housing. Best offers to Ken Meallin, VK3NJ, 69 Caroline St., South Yarra, Vic. Phone 68-1032, home 25-5515.

FOR SALE: Hallicrafters five-band, s.s.b., c.w. Transceiver, Model SR150, complete with a.c. power supply, VOX, PTT, 125 watts p.e.p. input, instruction manual, $350 o.n.o. VK1AN, 37 Ingamells St., Garran, A.C.T., 2605. Phone (062) 81-5905.

FOR SALE: R.C.A. Beat Frequency Oscillator, ex P.M.G. Labs. $15. A. G. Fisher, VK3VX. Phone 81-1853 (Melb.).

FOR SALE: Yaesu Musen FR-DX-400 Amateur Communications Receiver. In as new, immaculate condition. Only a few months old. $295. Les Andrews, 49 Lord St., Roseville, N.S.W., 2069, or Phone 46-1022 after 6 p.m.

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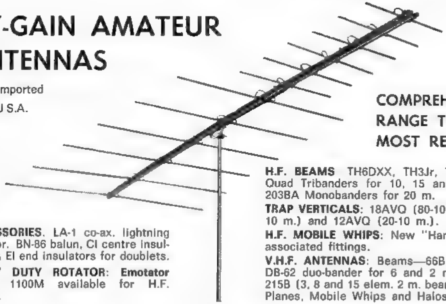

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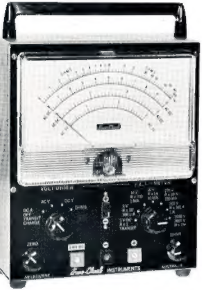

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